Vol. XVII No. 1

DISSERTATION ABSTRACTS

ABSTRACTS OF DISSERTATIONS AND MONOGRAPHS IN MICROFORM

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1957

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INTRODUCTION

This year *Dissertation Abstracts* will carry, as the 13th issue of Volume XVII, an index to all doctoral dissertations published in the United States and Canada. This issue will be titled *Index to American Doctoral Dissertations*, and will be a continuation of *Doctoral Dissertations Accepted by American Universities*.[1] The joining of these two reference works makes it possible for librarians to have an integrated bibliographical research tool relating to doctoral dissertations under one cover.

Dissertation Abstracts will continue to provide abstracts of dissertations by recipients of doctoral degrees from graduate schools cooperating with University Microfilms in the publication of complete dissertation texts on microfilm, on Microcards, or as microprint. At the end of each abstract will be found an indication of the number of pages in the original typescript and the Library of Congress card number, for the convenience of scholars and research workers. In some instances *Dissertation Abstracts* will be found to be an adequate substitute for the published dissertations.

The *Index to American Doctoral Dissertations* will be a complete indexed listing of dissertations by students who were granted doctoral degrees during the previous academic year, and including those abstracted in *Dissertation Abstracts*, arranged by degree-granting institutions under appropriate subject headings. An alphabetical author index will be included.

The tabular material which has been an established part of its predecessor volume will be included in full, so arranged that statistical summaries can be maintained with no break in continuity.

It is hoped that those who use *Dissertation Abstracts* will continue to make suggestions for its improvement, as these are vital to its continued life and growth. Several suggestions for changes in the headings used for indexing purposes have been received, and a committee of the Association of Research Libraries is reviewing the indexing system at the present time as a result of these suggestions.

[1] Arnold H. Trotier and Marian Harman, (eds.), *Doctoral Dissertations Accepted by American Universities.* (New York: H. W. Wilson Co., 1933-1955.)

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The Table of Contents lists in alphabetical order the principal subject headings of the dissertations abstracted. For the convenience of readers an alphabetical author index is included following the abstracts.

AGRICULTURE, GENERAL

THE INFLUENCE OF ORGANIC MATTER AND CERTAIN ANIONS ON THE PHOSPHORUS CONTENT OF THE OAT PLANT

(Publication No. 18,365)

Dorothye J. Albritton, Ph.D.
Kansas State College, 1956

This investigation was designed to study the influence of oats straw and alfalfa residue organic matter, citrate, oxalate, silicate, and tartrate anions on the phosphorus content of the oat plant. The study provided an opportunity to evaluate the influence of the treatments, by means of a 7 x 7 latin square greenhouse experiment, on yields, percentage phosphorus, and phosphorus uptake for the grain and straw. The rates of 4000 ppm organic matter, 1000 ppm anions, and sufficient essential nutrients, except phosphorus, were applied to 3 kilograms of Parsons silt loam surface soil, moistened and incubated for two weeks. Two crops were grown in this culture medium. Essential nutrients were added for the second crop plus the equivalence of 200 pounds of P_2O_5 to four replicates of each treatment.

The silicate treatment gave the best visual growth response, whereas the differences among the other treatments were not too pronounced.

The mature crop was harvested, dried, weighed, ashed by the $MgNo_3.6H_2O$ alcohol method, and phosphorus colorimetrically determined by the Truog-Myer method.

The organic matter and anion treatments gave significant increases in yields, percentage phosphorus, and phosphorus uptake for grain and straw of the first oat crop.

The silicate anion was best with respect to yields and phosphorus uptake for both grain and straw, and was significantly better than the control in percentage phosphorus for the straw.

The oxalate anion gave significant increases of grain and straw yields, percentage phosphorus, and phosphorus uptake by the grain.

The organic matter treatments were superior in percentage phosphorus for both grain and straw.

Data from the second oat crop with respect to organic matter and anion treatments did not agree with data for the first oat crop, probably due to the great amount of variability between replicates. These treatments attained significant differences only in percentage phosphorus and phosphorus uptake for the straw of the second oat crop. The tartrate anion gave the greatest straw yield, percentage phosphorus, and phosphorus uptake.

An additional experiment of Si_2O_5:P_2O_5 combinations was grown in conjunction with the second oat crop. The Si_2O_5:P_2O_5 experiment of six replications in nine treatment combinations was grown in a completely randomized experiment. The rates of 0, 500, and 1000 ppm Si_2O_5 and 0, 15, and 30 ppm P_2O_5, plus supplementary nutrients, were applied to 3 kilograms of soil.

The analytical procedure was the same as that conducted upon the first oat crop.

Statistical analysis showed the Si_2O_5:P_2O_5 treatments to be non-effective insofar as average grain yields were concerned. The effects were significant at the 1 percent level with respect to percentage phosphorus and significant at the 5 percent level with respect to phosphorus uptake for the oat grain.

Statistical analysis indicated that Si_2O_5:P_2O_5 treatments caused significant increases in straw yields and phosphorus uptake at the 1 percent level, but these effects were not significant insofar as percentage of phosphorus was concerned.

For the second oat crop of the Si_2O_5:P_2O_5 experiment, the treatment of 1000 ppm of Si_2O_5 gave significant increases over the control in yield of oat grain, in percentage phosphorus, and phosphorus uptake for both grain and straw of the oat plant. The effect of addition of 500 ppm of Si_2O_5 was similar but smaller in magnitude.

Addition of either 15 or 30 ppm of available P_2O_5 was especially effective in regard to increasing yield, percentage of phosphorus, and phosphorus uptake by the oat plants.

43 pages. $1.50. Mic 57-1

THE INFLUENCE OF NITROGENOUS FERTILIZERS AND LEACHING ON THE BASE STATUS OF SOILS

(Publication No. 17,500)

Joseph Baker, Ph.D.
State College of Washington, 1956

The effects of source of NH_3-N^1 and of irrigation on the base status and reaction of soil has been studied under laboratory conditions. This was accomplished by leaching columns or irrigating simulated furrow cross section units filled with neutral, base-saturated Ritzville silt loam containing banded applications of $(NH_4)_2SO_4$ or $(NH_4)_2CO_3$. The two salts are different in acid-base properties; solutions of $(NH_4)_2SO_4$ are essentially neutral supplying only NH_4^+ ions whereas solutions of $(NH_4)_2CO_3$ are basic supplying both NH_4^+ ions and molecular NH_3. Both NH_3 and $CO_3^=$ (or HCO_3^-) act as bases. Differences between the two salts depend upon the difference in basicity as determined by proportion of NH_4^+ to NH_3 and the degree of removal of $CO_3^=$ by leaching.

The initial irrigation of soil columns in which $(NH_4)_2SO_4$ or $(NH_4)_2CO_3$ was banded at the rates from 323 to 1130 pounds of N per acre had different effects on base status and reaction of the soil. In $(NH_4)_2SO_4$-treated columns, displacement of bases and sorption of NH_4^+ took place with little change in soil reaction. In columns treated with $(NH_4)_2CO_3$, some NH_4^+ was sorbed in exchange for soil bases but some was sorbed as NH_3 which greatly increased the soil pH value.

The columns were irrigated 22 times over a period of 38 days. Composition of the leachates indicated three distinct phases during the leaching program according to the mechanism dominant in moving NH_3-N or bases from the soil into the leachate. In the first phase, displacement of bases by NH_4^+ was prominent and the Ca+ Mg/K ratio of the leachate was wide. In the second phase, soluble salts had disappeared and nitrification was not yet active; hydrolysis was the principal mechanism for removal of bases and NH_4-N. The Ca+ Mg/K ratio of the leachate was narrow. In the last phase, nitrification was extensive and bases and NH_4-N were extensively displaced by H^+; the Ca+ Mg/K ratio was again wide. Maximum movement of bases and NH_3-N from the $(NH_4)_2SO_4$-treated columns occurred during the first phase. In contrast, the $(NH_4)_2CO_3$-treated columns sorbed more of the applied NH_3-N and lost fewer bases initially but lost both NH_3-N and bases more extensively during the later phases of leaching.

Under heavy leaching the initial differences produced by $(NH_4)_2SO_4$ and $(NH_4)_2CO_3$ in the soil were greatly reduced since alkaline products of exchange capable of neutralizing H^+ formed during nitrification were removed. The residual effects of the two NH_3-N carriers were then similar.

The effect of a single light or heavy irrigation upon the distribution of NH_3-N, soluble cations, and soil reaction in the vicinity of an irrigation furrow was investigated. Movement of NH_3-N from the $(NH_4)_2SO_4$ band was extensive; under light irrigation both upward and downward movement occurred, whereas downward movement was predominant under heavy irrigation. The movement of NH_3-N from the band of $(NH_4)_2CO_3$ was limited and little influenced by irrigation intensity. The $(NH_4)_2SO_4$-treated units contained large amounts of soluble cations but units treated with $(NH_4)_2CO_3$ had only negligible quantities. Soil pH was increased slightly around the band of $(NH_4)_2SO_4$ following irrigation, but was greatly reduced over a wide area wherever NH_4^+ was nitrified. Soil reaction about the band of $(NH_4)_2CO_3$ was strongly alkaline following irrigation and much of the area remained above neutrality even after 40 days. Nitrification continued for perhaps another 20 or 30 days before being stopped for the lack of moisture. Analysis of the completely dried soil indicated large amounts of NH_3-N in the vicinity of the fertilizer bands. Presumably nitrification was much impeded by the high concentrations of NH_3-N about the bands, as well as by lack of moisture.

The residual effects of the NH_3-N carriers studied were appreciably different only in the initial stages of irrigation. Upon the removal of alkaline products of exchange by the extensive leaching of the soil, differences in base status and soil reaction effected initially were greatly reduced. 149 pages. $2.00. Mic 57-2

1. This term is used whenever NH_4^+ and NH_3 forms are not distinguished.

THE ROLE OF ALUMINUM IN THE FIXATION OF PHOSPHATE BY SOILS

(Publication No. 19,776)

Willard Lyman Lindsay, Ph.D.
Cornell University, 1956

Solubility criteria were used in this study to evaluate the role of aluminum in the fixation of phosphate by acid soils. The concentrations of aluminum and phosphate ions in soil extracts were compared with those calculated from solubility products of gibbsite and variscite.

A method was developed for the determination of aluminum in aqueous extracts of soils. In this procedure, thioglycollic acid was found to be effective in eliminating the interference of iron. Studies of the recovery of aluminum indicated that the method was reliable for the determination of aluminum in soil extracts.

It was shown experimentally that, in accordance with the Gouy theory of the diffuse double layer, the value of (pH-1/3pAl) for a given soil remained relatively constant as the concentration of $CaCl_2$ in the soil suspension was increased from 0.001 to 0.1 M.

Studies were made of the mechanism of phosphate fixation in seven samples of Mardin silt loam ranging in pH from 4 to 6. The soils were treated with phosphate at the rate of 0, 500, and 1000 lb. P_2O_5 per 2,000,000 lb. of soil. Samples of the soils were extracted with 0.01 M $CaCl_2$ after 24 hours, two months, and six months following the addition of phosphate. The pH and the concentrations of aluminum and phosphate ions were determined in the extracts. The solubility measurements indicated that variscite was not present in the soils treated with 0 and 500 lb. P_2O_5 per 2,000,000 lb. of soil. With the 1000 lb. application rate, variscite may have formed initially, but after two months the phosphate concentration in the extracts was found to be lower than that calculated from the reported solubility product of this compound.

With increasing soil pH, the value of (pH-1/3 pAl) increased indicating that the extracts were not in equilibrium with gibbsite. As the pH and concentration of aluminum decreased immediately after the addition of phosphate, it appears that both aluminum and hydroxyl ions reacted with the added phosphate and decreased the value of (pH-1/3 pAl) for the soil. With time the original value of (pH-1/3 pAl) tended to be restored.

The concentrations of aluminum, phosphate, and hydrogen ions were determined in filtrates from the clay suspensions to which phosphate and gibbsite had been added. It was found that conditions were favorable for the formation of variscite only when 0.05 millimole of phosphate was added per gram of clay. As with the soils, gibbsite was not in equilibrium with the aluminum and hydroxyl ions in solution.

Supplementary studies of the solubility of gibbsite and synthetic aluminum phosphate precipitates showed that equilibrium between these compounds and their constituent ions in solution was attained only slowly. Owing to the slow rate of the reactions involved in the formation and transformation of these compounds, some caution must be exercised in interpreting solubility measurements made with soils.

From these studies it may be concluded that: (1) aluminum ions participate in the fixation of phosphate in soils;

(2) variscite is too soluble to persist in most soils; and
(3) the soil solution is seldom in equilibrium with gibbsite.
103 pages. $1.50. Mic 57-3

SOIL-PLANT RELATIONSHIPS ON THE QUILLAYUTE PRAIRIE IN WESTERN CLALLAM COUNTY, WASHINGTON

(Publication No. 17,513)

Frederick B. Lotspeich, Ph.D.
State College of Washington, 1956

A study inquiring into the soil-plant relationship of the soils of the Quillayute Prairie has been made using ecological, physical, chemical, and mineralogical methods. These soils are characterized by a high organic matter content in the surface horizons, little or no horizon differentiation, high total cation exchange capacity, very low degree of base saturation, and strongly acid reaction.

These soils have formed under a temperate, humid climate from a silty glacial sediment deposited in an estuarine environment. This material is glacial flour from the valley glaciers that occupied the valleys of the western Olympics during the late Pleistocene. The original rocks are of early Tertiary age and are chiefly composed of impure sandstones, graywacks, and arkoses.

The prairie vegetation is dominated by bracken fern although many other species are also present. Phenology is such that many plants have matured by the time that the bracken fern has fully leafed out and thus do not compete for light with the dominant fern. Although trees have never grown on the open prairie, they grow vigorously once they become established, and the succession appears to be from prairie to the climax hemlock forest now surrounding the prairie.

The prairie soil under forest loses its very dark color but otherwise there is little change from the prairie to the forest plant communities. The high exchange capacity is primarily related to the soil organic matter and secondarily to the clay content which is highest in the surface horizon. There is no horizon where clay or oxides have accumulated; the texture of all horizons is silty with silt content of the order of 80 per cent. Reaction under both forest and prairie is strongly acid and in all cases there is a steady increase in pH with depth.

Illite and montmorillonite are the chief clay minerals although several other clay-size minerals are indicated in trace quantities. Goethite appears to be an important constituent of the colloidal fraction of these soils and is believed to be inherited from the parent material. The light minerals are dominated by quartz and plagioclase with the percentage of quartz being higher than plagioclase in the surface horizon. Biotite is a minor constituent but its percentage increases with depth. Hornblende is the dominant heavy mineral closely followed by the epidote group. The common resistant minerals zircon, tourmaline, and garnet are present only in very small quantities.

Weathering of soil minerals in place does not appear to have taken place to any appreciable extent. The presence of large quantities of feldspar in the light mineral fraction and the dominance of hornblende in the heavy mineral suite indicate a relatively low weathering stage. Based on the evidence available, the Quillayute soil has formed from a recent sediment, and although possessing some features of an old soil, is in reality quite young.

The Quillayute soil does not possess any features of a podzolic soil, except an acid reaction; neither does it have features commonly associated with latosols. However, the lack of horizons, the even distribution of oxides within the profile, and the total environment indicate that mild laterization has been operative in this region.
114 pages. $1.50. Mic 57-4

UNIFORMITY TRIAL EXPERIMENTS IN MARKETING RESEARCH

(Publication No. 19,778)

Murray Alexander MacGregor, Ph.D.
Cornell University, 1956

Uniformity trial experiments were used to study the sales variability in eggs, apples, carrots, potatoes, milk, bread, cinnamon, bacon, frozen orange juice, frozen peas and vegetable soup. The daily sales of these commodities were recorded in seven supermarkets for a period of six weeks from August 15 to September 24, 1955.

Analyses of variance and covariance were used to study the variability in commodity sales associated with the variability of the following effects: store, week, day, price of the commodity, number of customers, grocery, meat and produce sales and the interactions, store x week, store x day and week x day.

Variability in commodity sales is more closely associated with the store, week, day and interaction effects than with any other group of effects studied. If any or all of these effects cannot be isolated and controlled then most of the variation in commodity sales resulting from these effects can be eliminated by a covariance analysis using either number of customers or the sales of the relevant product group as the covariate.

For most commodities the week to week variation in sales is small. The day to day variation in commodity sales is relatively large as is the store to store variation. The store to store variation is smaller than the day to day variation.

The store x day interaction effect is usually the largest of the interaction effects; the store x week interaction effect is the smallest. The week x day interaction effect is relatively small.

The store x day interaction effect is attributable mainly to the difference in commodity sales between the first three days and the last three days of the week; this difference is not consistent among stores. The last three days of the week tend to interact more with stores than the first three days of the week.

The three-factor interaction store x day x week is not a particularly good estimate for the residual variability in commodity sales. As a result, the coefficients of variation for commodity sales are relatively high; the magnitude of the coefficients of variation is highly variable among commodities.

A square root transformation of the daily unit sales of a commodity reduces the coefficient of variation by about 50 per cent.

The residual commodity sales variances are not homogeneous among stores. In some instances the variances appear to be directly related to the means. The square root transformation stabilizes these variances and this accounts for part of the increased precision due to transforming the data.

The three-factor interaction effect is not as large with the transformed data as it is with the untransformed data. This in part accounts for the lower coefficient of variability obtained by transforming the data.

The sampling rate is reduced appreciably by transforming the data. This does not effect the confidence levels used with the untransformed data.

It is suggested that large gains in precision can be obtained by applying a suitable transformation to this type of marketing data. Further research on transformations is warranted to substantiate this observation.

347 pages. $4.45. Mic 57-5

EFFECTIVENESS OF MERCHANDISING PRACTICES ON MILK CONSUMPTION

(Publication No. 19,780)

Joseph Frank Metz, Jr., Ph.D.
Cornell University, 1956

The primary purpose of the study was to find means of increasing per capita consumption of milk. Preliminary investigations were made to determine the present methods of distribution and consumption of milk, to evaluate industry practices and to seek new merchandising practices that offer promise for increasing milk sales. Areas investigated included store sales of milk, size of containers, milk container carriers, quantity discounts and keeping quality of milk, milk vending machines, milk drinks and price discounts on fluid cream. In these investigations efforts were restricted to relatively few outlets in a given market.

A plan was developed to use an entire community for a test market in which total changes in milk consumption could be measured by obtaining information on all dealers and store sales. A questionnaire survey was made of all households in the community to obtain information regarding milk consumption habits and purchasing patterns. At the time of the survey a promotional type of program was tested for its effects on consumption. A set of six glass tumblers labeled with the word MILK was distributed to each family as part of the program.

The characteristics of the population in the test community were similar to those for the United States with respect to age and sex distribution and size of family.

About 95 per cent of the families in the community were interviewed. Of those interviewed 95 per cent reported that fluid milk was purchased during the week preceding the interview. Fifteen per cent of the population did not drink milk.

Milk was consumed with 62 per cent of all meals eaten at home and in addition was used an average on once every two days between meals. About two per cent of the total fluid milk purchased was used for company. An equal amount was fed to pets.

Skim milk was purchased by eight per cent of the families and accounted for five per cent of the total volume of milk consumed. Chocolate drink and buttermilk sales were of minor importance. Per capita consumption among families using both skim milk and whole milk was greater than for families using only whole milk. Part of the skim milk substituted for whole milk.

Children participating in the school milk program consumed about the same amount of milk at home as children who did not participate. The school milk program added to total consumption.

The promotional program had no measurable effect on milk sales. Changes in total milk sales which did occur were associated with changes in population.

A measurement of response bias was made by comparing dealer records with respondent statements concerning the amount of milk purchased from dealers. Total milk purchases were overstated by 13.5 per cent. The chief source of bias was the person interviewed. There was some evidence of bias originating with enumerators, but this did not appear to be an important source.

The experimental work to date indicates that it is difficult to find marketing practices that can successfully increase milk consumption. Apparently milk purchasing habits are highly fixed and are not easily altered. Additional research on this problem is warranted.

101 pages. $1.50. Mic 57-6

INFLUENCES OF TREADING ON GRASSLANDS

(Publication No. 19,782)

Kevin Francis O'Connor, Ph.D.
Cornell University, 1956

The role of treading as an element in grassland management is studied, with particular reference to its influence on soil properties and herbage production in improved grasslands in central New York State. The incidence of treading by man, animals, tractors and other implements is established in a review of grazing behaviour studies and a critical analysis of the dimensions and mechanics of these treading agents. Treading influence on soils is reviewed with special attention to the principles of soil deformation established in engineering research. Studies of grasslands and other ecosystems from the viewpoint of treading influence and the effects of soil compaction are also reviewed. As far as possible, direct influences of treading on plants are distinguished from effects due to changes in soil physical conditions.

Results are presented and discussed of experiments at Cornell University Agricultural Experiment Station involving cattle treading at regular intervals during summer, 1954, on closely-clipped and unclipped swards. It is shown that treading at low intensities on a four year old orchard grass dominant pasture resulted in an increased soil volume weight in the uppermost four inches of the profile, the effect decreasing with depth. Compaction was more frequently over an eighteen week period. Compaction was less severe when the ground surface was protected by dense and tall pasture. Excessively wet conditions were avoided at times of treading, but no increase in soil compaction was observed when pastures were watered immediately before treading. Deep hoof prints, however,

were formed in the same pasture in 1956 when the soil was very wet and of low bearing strength.

Evidence is presented of a reduction in water infiltration and of decreases in pore space accompanying the increase in volume weight.

Orchard grass was reduced in vigor and abundance in pasture trodden after mowing, especially at frequent intervals. Reduction in herbage production from treading clipped pastures was as much as thirty percent. Treading had less effect on production than cutting frequency during the year of treatment, but the effects of treading on herbage production in the following spring were greater than effects attributable to previous differences in cutting frequency. No reduction due to treading was detected on pasture trodden when unmown.

Results of a tractor treading experiment on closely-clipped pasture plots indicated that treading damage to orchard grass and tall fescue occurred through mechanical breakage and abrasion of existing tillers with consequent twenty percent reduction in leaf growth and seventy percent reduction in number of new tillers. Existing stems of European birdsfoot trefoil were broken with consequent lower growth from axillary buds. Under very dry conditions, this tractor treading resulted in no detectable increase in soil volume weight.

A further experiment showed that a volume weight of 1.25, slightly higher than the maximum developed in the first cattle treading experiment, did not adversely affect the growth of ryegrass or orchard grass.

It is concluded that in both the cattle and tractor experiments, vigor, persistence and production of desirable species were reduced by treading. The soil was not compacted seriously enough to affect plant growth and the effects on vegetation were direct influences of treading on the exposed, freshly cut, erect tillers of bunch-type grasses. From observation of the effects of treading on similar pastures in very wet soil conditions, it is suggested that both soil deformation and plant injury may be subject to great variation, with different material and in different weather conditions.

The significance of these findings to the conduct of agronomic research and to trends in grassland management is briefly discussed. 194 pages. $2.55. Mic 57-7

A GREENHOUSE METHOD FOR DETERMINING THE DISEASE REACTION OF POTATO SEEDLINGS TO COMMON SCAB CAUSED BY STREPTOMYCES SCABIES (THAXT.) WAKS. & HENRICI

(Publication No. 20,024)

Arthur Paul Pieringer, Ph.D.
Cornell University, 1956

The testing of potato seedlings for resistance to common scab, caused by Streptomyces scabies (Thaxt.) Waks. & Henrici, is a time-consuming and laborious task. The usual testing method of growing plants in fields infested with the causal organism tends to produce variable results.

As an aid in breeding for scab resistance, several greenhouse methods of determining the disease reaction of seedling potato plants were studied. The tests were conducted on plants in various stages of development from populations segregating for scab resistance.

All attempts to induce infection by S. scabies on foliage, stems, or roots of young potato seedlings grown in the greenhouse were unsuccessful.

Tuber infection occurred under greenhouse conditions if seedlings were grown to maturity in soil infested with the scab organism. An infested mixture consisting of equal parts of vermiculite and normal potting soil was found to be superior to infested normal potting soil as a medium for inducing tuber infection and for the development of susceptible-type scab lesions.

Several methods of infesting the vermiculite-soil mixture were compared. On the basis of tuber infection and on the number of susceptible lesion types produced, it was found that infesting the mixture prior to the time seedlings were transplanted was superior to all methods tested. No difference in amount of tuber infection was detected when the vermiculite-soil mixture was infested with inoculum dilutions of 1:3 or 1:5 used at the rate of 5, 10, 15, or 20 ml per 3-in. pot.

The infested vermiculite-soil combination was found equally usable with plants produced from true seed or those produced from seed tubers. Infection results obtained when plants were grown in the greenhouse in the infested vermiculite soil mixture were comparable to those obtained when plants were grown under conditions favorable for the development of S. scabies in field exposure plots.

The physical condition of the soil mixture was improved when the vermiculite was infested with the scab organism before it was added to the soil. Over 80 per cent of the vermiculite particles were found to be infested with S. scabies. The chief value of the vermiculite in the soil mixture is that it provides good physical distribution of the organism throughout the medium.

The addition of vermiculite to the normal potting soil had no appreciable effect on the pH of the soil. It did, however, reduce the water-holding capacity of the soil, but this could not be shown to affect the viability of S. scabies.

Prolonged periods of high daytime greenhouse temperatures influenced the soil temperature and had a depressive effect on the viability of S. scabies. As a result, the amount of tuber infections obtained was reduced.

Tests conducted to correlate the amount of chlorogenic acid in the cortical tissue of the tubers with resistance to S. scabies produced variable results. The type of tuber periderm formation was an accurate measure of tuber resistance to S. scabies. Tubers in which the periderm consisted of distinct layers of living cells were resistant to the scab organism, whereas those in which the periderm consisted of a mantle of collapsed, obviously dead cells were susceptible. 58 pages. $1.50. Mic 57-8

AGRICULTURE, ANIMAL CULTURE

SYNTHESIS OF THIAMIN IN THE INTESTINAL TRACT OF RATS AND PIGS

(Publication No. 17,520)

Kendall Winfield Scott, Ph.D.
State College of Washington, 1956

To determine the extent of intestinal synthesis, absorption, and storage of thiamin and the effect of antibiotics, dietary fat levels, and supplemental thiamin, two experiments were carried out.

In Experiment I, 72 weanling, male, albino rats were allotted at random to 18 treatments of four rats each. All rats were caged and fed, and collections (fecal and urine) made individually. After an 18-day period, the animals were sacrificed; the carcass, minus the digestive tract content, was ground in a food chopper grinder, homogenized in a Waring Blender with 0.1 $\underline{N}$ H_2SO_4, incubated under toluene with papain and clarase, made to volume, filtered, and thiamin assays performed on the filtrate. Thiamin assays were made on the feces and urine. The rations consisted of: 26 per cent casein (G.B.I. vitamin-free), 47 per cent raw potato starch, 5 per cent cellulose fiber, 2 per cent minerals, plus all vitamins except thiamin. Treatment variables were fat (corn oil) at levels of 0, 2, and 20 per cent, aureomycin (15 mg/kg ration), and thiamin at 0, 0.8 mg/kg, and at 3.0 mg/kg of ration. Weight, feed consumption, and health of the animals were noted.

The results of Experiment 1 are as follows. When the fat levels in the diet were increased there was a significant decrease in the free thiamin excreted in the urine. When the thiamin content of the ration was increased from 0 to 0.8 mg/kg ration or 3.0 mg/kg diet there was a significant increase in urinary thiamin. When both the fat level and the thiamin level of the diet were increased, there was a significant increase in urinary excretion of thiamin.

The thiamin content of the feces was significantly decreased when the thiamin level of the diet was increased. Fecal thiamin also decreased when fat and thiamin were both increased, as was true with fat times aureomycin treatment.

Feed efficiency (gm. of feed per gm. of gain) and total gain were significantly increased by treatments of fat, thiamin, and fat times thiamin combinations. Treatment with aureomycin did not significantly increase feed efficiency or rate of gain.

Considerable intestinal synthesis was evidenced by all groups as calculated by the amount of thiamin required contrasted with the amount utilized.

In Experiment II, 16 pigs, averaging 19.4 pounds and five to six weeks of age were assigned at random to treatments of fat levels, aureomycin, and thiamin supplements. Liver and muscle biopsy samples were taken at the beginning and at the end of a 42-day trial. Each pig was caged individually in coprophagy-proof cages with feed consumption and weight gains noted. The purified basal ration consisted of 2 per cent fat (corn oil), 61.8 per cent starch (raw potato), 26 per cent protein (isolated soybean protein #220), 4 per cent mineral mix, 1 per cent vitamin mix, and 0.2 per cent d-1-methionine. In the ration containing 20 per cent fat, the fat replaced starch.

At the end of the trial, thiamin assays were performed on the liver and muscle samples.

Results of this experiment were as follows. When the fat level was increased from 2 to 20 per cent, or when supplemental thiamin was given, there was a significant increase in muscle deposition of thiamin. This was also true when aureomycin or a combination of aureomycin and thiamin was used.

None of the treatments used (i.e., fat levels, aureomycin, or thiamin supplementation) had a significant effect on the liver content of thiamin.

Feed efficiency was significantly increased with treatments of fat, thiamin, fat times thiamin, aureomycin, and fat times aureomycin.

The average daily gain was significantly increased by treatments of fat and/or fat times aureomycin.

97 pages. $1.50. Mic 57-9

AGRICULTURE, FORESTRY AND WILDLIFE

WILDLAND PLANNING PROCEDURES WITH EMPHASIS ON RECREATIONAL LAND USE IN THE TAHQUAMENON-PICTURED ROCKS REGION, UPPER PENINSULA OF MICHIGAN

(Publication No. 19,710)

Robert Woodrow McIntosh, Ph.D.
University of Michigan, 1956

The purpose of this study is to develop wildland planning procedures and to illustrate their application to achieve intelligent recreational land use in a portion of Michigan's Upper Peninsula. The timeliness and importance of such procedures arise from the rapidly growing demand for use of the natural landscape for recreation. In densely populated southeastern Michigan, it is becoming extremely difficult to satisfactorily meet these demands. Future needs will have to be increasingly provided for in northern Michigan where wildlands are more abundant. An unusual acceleration in recreational use of the study region is in prospect. The Straits of Mackinac Bridge is under construction. When completed, it will greatly improve accessibility. The region will then be within a day's drive from southern Michigan. A four-lane highway, integrated with the bridge, is planned as part of the national system of interstate highways. With this rapid increase in use, problems will undoubtedly arise in the safeguarding of scenic and wilderness values, so important to outdoor recreational enjoyment.

Presented in the first portion of the report are some basic studies regarding the region and its broad environment. These include significant information concerning the economic, physical, and technological conditions and trends which affect recreational land use. The result of these analyses is an estimate of the number of persons expected to visit the region over a 40 year period, 1953 to 1993. An inventory of the region provides data on the currently available resources for recreational use. Additional area analysis produces facts regarding history, present land use pattern, ownership of land, intent in land ownership, and transportation facilities. Standards are needed to measure capacity for recreational use. These

standards, in terms of land space, are then applied to the available land resources. The measure of optimum recreational land use capacity is in two parts: (1) an estimate of the present wildland carrying capacity, (2) an estimate of the future carrying capacity possible with intelligent use.

In order to balance demand with capacity, goals are established. Examples of goals are additional new parks, expansion of facilities in existing parks, creation of natural area preserves, increased cottage development, greater acreage in hunting and fishing clubs, more commercial facilities, and improved roads. A land use plan illustrates definition of goals sought. The plan is depicted in map form.

There are various courses of action for framing and implementing a regional wildland plan. Several differently constituted land planning agencies or groups could be effective. Regardless of its form, effectuating the plan will involve four concepts: (1) regulations in the use of land, (2) private and public policy with respect to management of productive lands, (3) provision of public recreation and transportation facilities, (4) public education.

Conclusions are as follows: (1) A projected six-fold increase in recreation seekers to the region is expected from 1953 to 1993. (2) The inventory of surface natural resources revealed that these are very appealing and of outstanding character. (3) Formulation, development, and effectuation of wildland planning procedures are essential to the maintenance and enhancement of these resources in consideration of the expected recreational use. (4) The most feasible device for implementing the plan is a landowner's cooperative planning association. This device rests upon private contract to bring about desirable and orderly development of wildland natural resources.

228 pages. $2.95. Mic 57-10

reduced this effect. The frequency of mutations in the X_2 seedlings, on the other hand, was not affected by either storage or different concentrations of oxygen.

Neither storage (up to eight weeks) nor the various concentrations of oxygen produced any effects in non-X-rayed seeds.

The data revealed a correlation between frequency of chromosomal aberrations and percentages of germination, field emergence, and mature plants and height of seedlings. This, however, was thought to be a chance correlation rather than a cause and effect relationship.

No correlation was found between visible chromosomal aberrations and X_2 seedling mutations. To account for this lack of correlation, the following two hypotheses were presented: (1) different processes may be involved in the production of visible chromosomal aberrations and mutations, and (2) the X_1 plants harvested for mutation studies contained the same maximum amount of irradiation-induced damage regardless of the post-treatment.

The post-irradiation oxygen effect on chromosomal aberrations was more adequately explained by the potential or latent break hypothesis suggested by Lüning (1954) and Swanson (1955a and 1955b) or by a hypothesis which assumed some secondary effect of X-rays. The breakage and recombination hypotheses of the oxygen effect suggested by Giles and Riley (1950) and Schwartz (1952) respectively were not supported by the data of this study.

An explanation of previously observed frequency of spontaneous chromosomal aberrations in aged seeds (Gunthardt et al., 1952) and practical applications of the present results in the fields of plant breeding and radiotherapy are also discussed.

56 pages. $1.50. Mic 57-11

AGRICULTURE, PLANT CULTURE

MODIFICATION OF X-RAY EFFECTS IN DORMANT BARLEY SEEDS BY POST-TREATMENTS OF OXYGEN AND NITROGEN

(Publication No. 17,498)

Jack Donald Adams, Ph.D.
State College of Washington, 1956

In order to determine the biological effects of storage and various oxygen concentrations after X-radiation, dormant barley seeds (Hordeum vulgare var. Himalaya) were irradiated with 7,500 r and stored, along with non-X-radiated seeds, in nitrogen, air, and oxygen for two, four, six, and eight weeks. The effects of the post-irradiation treatments were measured on: (1) frequency of chromosomal bridges and fragements; (2) percentages of germination, emergence in the field, and mature plants; (3) height of two-week-old seedlings; and (4) frequency of mutations in X_2 seedlings.

All of the measurements except mutations showed that irradiation damage increased as the storage period increased. Furthermore, oxygen treatments enhanced the storage effect (storage in air) while the nitrogen treatments

MATURATION CHANGES IN TOMATO FRUITS INDUCED BY IONIZING RADIATIONS (PARTS I - V)

(Publication No. 18,833)

Edward Eugene Burns, Ph.D.
Purdue University, 1956

Major Professor: Dr. Norman W. Desrosier

Effects of cathode ray irradiation on tomato fruits were studied. Attention was given to respiration, pigment formation, the degradation of pectin and starch in pure solution, and the susceptibility of irradiated fruits to pathogens. A method is described for aseptically preparing and holding halves of the same fruit for treatment and extended periods of observation without severe interference with the normal ripening phenomena.

Respiration rates were measured on individual fruits employing an infra-red gas analyzer. Carbon dioxide evolved was taken as an index of maturity initially and the fruits were grouped equivalently into sets for treatment at different radiation doses. The respiratory processes were evaluated immediately before and after exposure and periodically thereafter.

The respiratory pattern was severely altered as a result of irradiation and was proportional to the dose within the range applied to the fruits. The effect persisted

significantly for a period of up to 96 hours when the pattern returned to normal.

A splitting of starch molecules into smaller fractions occurred when pure starch was irradiated in aqueous solution. Reducing groups were exposed and a substantial fraction of malto-tetraose was produced. This indicated that the increase in respiration following irradiation might result from the increased availability of the substrate for the activities of respiratory enzymes.

The surface color of the tomato fruits and pigment content of phytofluene, beta carotene, gamma carotene, and lycopene were measured objectively. Whole fruits were used in the case of simultaneous color and respiration studies, and half-fruits were used to assess the effect of cathode rays on individual pigments.

The development of normal red tomato pigments is inhibited by radiation sterilization of the fruits. Fruit irradiated in a band around the equator showed normal color development over the unexposed blossom and stem ends with inhibition in the exposed area depending upon the dose applied. Chlorophyll content did not seem to be markedly altered, and there was a recovery of the pigment producing mechanism with time.

The content of phytofluene, gamma carotene, and lycopene pigments in tomato fruits ripening following irradiation was found to be significantly reduced. There was little effect upon the beta carotene content, however. It may be that beta carotene is not importantly involved in the development of red color in tomato fruits.

In contrast to the other pigments, the gamma carotene content of irradiated fruits differed markedly with the slight variations in the maturity of the fruit, and there was a highly significant interaction of treatment with time after exposure to ionizing radiations. This would indicate that of the pigments observed, gamma carotene production is most susceptible and does not recover as readily as the other pigments.

A lowering of resistance of tomato fruits to infection resulted from radiation. The incidence of infection was much higher and proceeded at an accelerated rate as compared to unirradiated specimens.

Pectin in aqueous solution exposed to ionizing radiations was observed to be split into smaller units or degraded. The increased susceptibility to infection might result from such activity in that the advance of the pathogens observed is characterized initially by a break-down of the pectic material between the cell walls of vegetative tissue.

The irradiation death-time curves for the tomato pathogens studied were similar to the curves obtained when heat is the lethal agent. 132 pages. $1.75. Mic 57-12

GENETIC AND PATHOLOGICAL STUDIES WITH DWARF BUNT OF WINTER WHEAT

(Publication No. 20,016)

Wade G. Dewey, Ph.D.
Cornell University, 1956

The objectives of this study were to gain information on certain phases of the life cycle of the dwarf bunt fungus; to examine possible methods of increasing infection in test nurseries; and to study the manner in which resistance to this pathogen is inherited.

The inheritance of resistance to dwarf bunt of wheat, incited by Tilletia brevifaciens G. W. Fischer (T. controversa Kuehn), was studied in crosses between a resistant selection from the Pacific Northwest and several susceptible Northeastern varieties. Because of the difficulty encountered in obtaining consistent dwarf bunt infection and the suggested similarity in reaction to T. brevifaciens and race T-16 of T. caries (D. C.) Tul., this latter race was used as a tester for dwarf bunt reaction. Reaction to a composite of T. foetida (Wallr.) Liro races common to New York was also recorded. Resistance appeared to be dominant and dependent upon several factors. Part of the data fit a duplicate factor hypothesis satisfactorily, but there are indications that the actual inheritance pattern is likely more complex.

The reliability of the T-16 test as an indicator of dwarf bunt reaction was examined by testing triplicate F_3 rows, derived from single F_2 plants, for reaction to T. brevifaciens, race T-16 and the composite of T. foetida races. Reactions to the 3 pathogens showed highly significant correspondence. Differential response was not infrequent, however, in any combination examined. Under the conditions of this study the composite of T. foetida races was essentially as good an indicator of dwarf bunt reaction as was race T-16.

Since some of the crosses were segregating for a number of morphological characteristics and for leaf rust reaction, opportunity was taken to examine these attributes for possible linkage with factors governing resistance to T. brevifaciens and race T-16. No evidence of linkage was found between awn type or chaff color and reaction to either of these organisms. A possible association between leaf rust reaction and reaction to race T-16 was indicated.

Straw cover applied to seedlings in dwarf bunt test nurseries in the fall and removed in the spring has been found to effect marked increases in the incidence of the disease. An attempt was made in this study to determine the approximate period of the winter or spring during which this cover exerts its effect and to ascertain if the effect could be duplicated by certain other treatments.

Application and removal of straw at different intervals through the fall, winter and spring indicated that the cover exerts its major effect during the relatively dormant winter months. Treatments involving fall and spring application of maleic hydrazide and fall and spring clipping duplicated the retarding effect of straw cover on plant growth but failed to effect similar increases in dwarf bunt incidence.

An experiment designed to give information on the stage of seedling growth at which ingress by the pathogen occurs indicated that this event may occur at a more advanced stage than previously supposed.

Part of the difficulty encountered in obtaining consistent infections under test conditions can be attributed to the irregularity with which chlamydospores of T. brevifaciens germinate. A series of experiments involving treatment with several acids, bases, growth regulating compounds, scarification with carborundum and exposure to numerous heat treatments was undertaken in an attempt to facilitate spore germination. None of the treatments shortened the period normally required for germination, nor did they increase the per cent germination over that observed for the controls.

123 pages. $1.65. Mic 57-13

COMPARISONS OF POTASSIUM-CHLORIDE AND POTASSIUM SULFATE ON MARYLAND GOLDEN AND NEMAGOLD SWEET POTATOES (IPOMOEA BATATAS LAM.)

(Publication No. 17,798)

Andrew Adrian Duncan, Ph.D.
University of Maryland, 1956

Supervisor: Dr. Francis C. Stark, Jr.

Effects of KCl, K_2SO_4 and equal combinations of the two, on the yield, chemical composition, storage behavior, processing and culinary qualities of Maryland Golden and Nemagold sweet potatoes were measured during 1954 and 1955. Rates of potash applications were 0, 60, 120, 240, and 480 pounds per acre. Nitrogen and phosphoric acid levels remained constant.

Total yields and yields of No. 1 size sweet potatoes did not differ between varieties, but were enhanced by increasing rates of either potash carrier, or the combination of the two. Yield of unmarketable, cracked roots was four times greater in Maryland Golden than Nemagold, and increased with rate of potash application; greatest increases occurred above 120 pound rate. Cracking was about one-fourth higher when K_2SO_4 was used.

K content of roots increased with rate of potash application, and was higher when KCl was used. Mg content of Maryland Golden was higher than Nemagold and was greater when K_2SO_4 was applied. Ca content was depressed by K_2SO_4 applications. KCl applications tended to increase Ca and depress Mg content. Differences in Ca and Mg content were attributed to differences in solubility of possible compounds formed in the soil solution.

Nemagold contained slightly more Cl than Maryland Golden. Cl was present in roots from all treatments, but was highest from KCl and lowest from K_2SO_4 treatments.

Dry matter percentage exhibited an inverse relationship to K, Ca, Mg, and Cl and was essentially the same for both varieties. K and Cl complemented each other in reduction in dry matter percentage.

Roots from no-potash plots were more subject to internal breakdown. Internal breakdown was in inverse relation to K content and in direct relation to dry matter percentages. Roots high in moisture were less subject to physiological deterioration. Maryland Golden was slightly more affected than Nemagold.

Firmness of processed roots increased with dry matter, and varied inversely with K and Ca content. Increased moistness was detrimental to firmness of the canned product. Processed Maryland Golden was firmer than Nemagold. Source of potash had no effect on the firmness of the canned product.

Losses in weight during storage could not be attributed to treatments. Organoleptic evaluation of firmness of baked sweet potatoes after storage failed to disclose detectable differences due to treatments. Weight loss during baking was attributable to loss of water. Roots low in moisture suffered the greatest percentage weight loss during baking. 88 pages. $1.50. Mic 57-14

SOME BIOCHEMICAL PROPERTIES OF OHIO SOILS AS AFFECTED BY APPLICATION OF ORGANIC RESIDUES (PARTS I AND II)

(Publication No. 17,387)

Lonzo Francis Green, Ph.D.
The Ohio State University, 1956

I. The Effect of Application of Organic Residues Having Similar Quantities of Nitrogen but Diverse C:N Ratios upon Growth, Composition, and Yield of Plants Grown on Two Ohio Soils.

The influence of wheat straw, green alfalfa tops, residue management, and mineral fertilizers on the nitrogen percentage of plant tissue and plant growth was determined in field trials. The investigation was conducted on two Ohio soils, Canfield silt loam and Brookston silty clay loam, for one year.

The early vegetative growth and nitrogen percentage of corn grown on Canfield silt loam was not significantly affected by incorporation of residues in mid-July as compared with residues left on the surface and incorporated in the spring. The application to the soil of eight tons of green alfalfa with a narrow C:N ratio resulted in a significant increase in growth and nitrogen percentage of corn as compared with the application of 5 tons of wheat straw with wide C:N ratio. The nitrogen percentage of corn leaf tissue decreased with the approach of maturity of the plants. Nitrogen percentage was the highest in leaves collected from plants grown on plots receiving 0-30-90 fertilizer and 100 pounds of ammonium sulfate. Corn grain yield was not significantly affected by the various soil treatments.

Residue management had no significant effect on the total forage produced by the indicator plant sudan grass on Brookston silty clay loam. The amount of forage produced by sudan grass was greater for alfalfa applications than for wheat straw. Treatment with one hundred pounds of nitrogen plowed down resulted in greater fresh weight production, more nitrogen, and taller sudan grass plants than did other treatments. The nitrogen percentage was the lowest on plots receiving wheat straw applications.

II. The Effect of Additions of Organic Residues Having Equal C:N Ratios on Carbon Dioxide Evolution and Some Nitrogenous Fractions in Three Ohio Soils.

Three Ohio soils, Clermont silt loam, Wellston silt, and Brookston silty clay loam, were treated with (1) $1\frac{1}{2}$ tons and 3 tons of wheat straw plus ammonium sulfate, and (2) $1\frac{1}{2}$ tons and 3 tons of green alfalfa tops per acre-furrow slice. The rate of carbon dioxide evolution, ammonification, and nitrification were determined for 5-, 10-, and 35-day incubation periods.

The nature of the added organic materials had no significant effect on nitrification, but evolution of carbon dioxide was greater in soils treated with green alfalfa, and there was a higher ammonia content in the soils as a result of wheat straw additions.

The rate of residue additions had no significant effect on rate of nitrification. Carbon dioxide evolution was not significantly affected by wheat straw additions; however, a significant increase was noted for the alfalfa additions.

Rates of alfalfa additions had no significant influence on ammonification.

Carbon dioxide evolution, ammonification, and mineralization of nitrogen was greatest for the Brookston soil, less for Wellston, and the least for Clermont.

Carbon dioxide evolution for 5-, 10-, and 35-day periods was significantly correlated with mineralization of nitrogen.

113 pages. $1.50. Mic 57-15

SOME EFFECTS OF INTERMITTENT FOLIAR WATER APPLICATIONS ON THE PHYSIOLOGY OF PLANTS AND THE GROWTH OF GREENHOUSE ROSES

(Publication No. 20,019)

Robert Wing Langhans, Ph.D.
Cornell University, 1956

The object of this work was to study some of the physiological aspects of plants when they were intermittently sprayed with a fine mist of water.

Among some of the physiological factors studied were leaf temperature, transpiration, translocation, stomatal condition and photosynthesis. The temperatures of the leaves were measured with copper-constantan, 30 gauge thermocouples, which were threaded into the leaf. It was found that the leaf temperatures of rose and chrysanthemum were lower under a mist of water than leaves not under mist. It was demonstrated that the initial temperature of the water used for misting had a very slight effect on the subsequent degree of cooling of the leaf. The cooling effect of the mist was due to the temperature of the water particle as it landed on the leaf and the temperature of this water was controlled by the amount of evaporative cooling which occurred as the particle fell from the nozzle to the leaf.

The results of the studies on transpiration showed that plants growing under mist lost almost no water by transpiration. The experiments on translocation using radioactive phosphorus as the indicator showed that the speed of translocation of P^{32} to the tops of plants was the same in both misted and non-misted plants, but the quantity of P^{32} translocated was less.

Microscopic observations of the stomates of rose leaves showed that the stomates of leaves under non-mist conditions would close about 2 p.m. on a bright warm day, while the stomates of leaves under mist would remain open throughout the day. Photosynthesis was measured by increases in dry weights of matched leaflets from rose plants growing under mist and no mist. The increase in dry weights of rose leaflets from mist and non-mist conditions was about the same from 6 a.m. to 2 p.m. The increase in dry weight of rose leaflets was greater in the mist treatment from 6 a.m. to 8 p.m. than the non-misted leaflets.

Dormant rose plants started with mist June 15, 1955; July 15, 1955; August 15, 1955 and September 15, 1955 produced more shoots and grew faster for the first two months than rose plants started using the normal commercial methods. The loss of rose plants under mist was negligible, and the loss of plants was approximately five per cent for the plants not misted.

A daily record of the number and length of the flowers cut from the mist on non-mist treatments showed that from the start of flower production up to the first of November, the rose plants in the mist treatments produced a greater total number of flowers and more total stem length than the non-misted rose plants. The flower production from November to May was similar for both the misted and non-misted treatments.

175 pages. $2.30. Mic 57-16

STUDIES ON THE CHEMOTHERAPY OF BACTERIAL BLIGHT OF CHRYSANTHEMUM, CAUSED BY ERWINIA CHRYSANTHEMI

(Publication No. 19,779)

Lorne Austin McFadden, Ph.D.
Cornell University, 1956

Bacterial blight of florists' chrysanthemum (Chrysanthemum morifolium Ram.), caused by Erwinia chrysanthemi Burkholder, McFadden and Dimock, is a newly recognized disease. Favored by high temperature and high relative humidity, the pathogen becomes systemic, causing a blight of the succulent terminal growth. The pathogen may enter vegetatively propagated cuttings during the rooting operation or may be carried over internally from symptomless stock plants.

A study was made on the possible use of systemic chemotherapeutants to control the disease. Over 24 materials were assayed, in vitro for activity against E. chrysanthemi. Greenhouse tests demonstrated that of the materials showing in vitro activity, Chloromycetin, streptomycin, Aureomycin, Terramycin, penicillin G and tetracycline almost completely inhibited the disease when cuttings were set in antibiotic solutions for 4 hours and then placed in a rooting medium on the greenhouse bench. However, when treated cuttings were placed in a moist chamber at 80^0F for 48 hours immediately following treatment and inoculation, much higher concentrations of antibiotic were required for equivalent control.

In further investigations, streptomycin gave excellent control of chrysanthemum blight under average greenhouse conditions either when absorbed from solution through the bases of cut shoots, when added as a drench to the rooting medium, or when added as a supplement to rooting-hormone powder. It was ineffective, however, when used as a foliage spray. Streptomycin phytotoxicity in chrysanthemum is characterized by an inhibition of rooting, chlorosis of terminal leaves, and reduced growth, depending on the concentration and duration of treatment.

A study was made on the influence of nutrient modifications on the development of disease and on the effectiveness of streptomycin in inhibiting disease expression when added to the nutrient solution. When streptomycin was added to nutrient solutions at 50 ppm, disease development was prevented in most instances. At very high levels of potassium, the characteristic chlorosis caused by streptomycin was almost absent. At low nitrogen levels, severity of streptomycin-induced chlorosis was reduced, but complete disease protection was not achieved. No marked differences in disease reaction were observed among plants inoculated with E. chrysanthemi but receiving no streptomycin, in the different nitrogen, potassium and phosphorus experiments.

It was shown that streptomycin was absorbed but not readily translocated in cut shoots of chrysanthemum. Under controlled conditions, treated cuttings were found to accumulate streptomycin only in the basal part of the stem. The leaves of streptomycin-treated cuttings did not contain large amounts of the antibiotic. Increasing the absorption time to a total of 24 hours did not appreciably increase the amount of streptomycin absorbed, although the solution, or at least the water phase, was absorbed by the cuttings in an almost linear relationship with time. Treated cuttings were found to retain detectable amounts of streptomycin for at least 37 days. It was not possible to demonstrate that translocation occurred when plants were sprayed with streptomycin, although some absorption did occur.

Streptomycin at 50 and 100 ppm was ineffective in preventing disease expression when the concentration of cells in the inoculum was high. Toxicity of streptomycin to E. chrysanthemi was found to be a function of time as well as concentration.

It was shown that a 6-hour treatment with 50 ppm and 100 ppm streptomycin delayed rooting for as much as 10 to 15 days. Inhibition of rooting was partially overcome when 75 ppm of indole-acetic-acid was added to solutions containing streptomycin sulfate. Using chromatographic means of separating the plant auxins it was found that the natural indole-acetic-acid content of streptomycin-treated cuttings was much reduced in comparison to non-treated controls. The rate of respiration of streptomycin-treated plant materials was shown to be reduced.

113 pages. $1.50. Mic 57-17

STUDIES ON THE CHEMOTHERAPY AND PHYSIOLOGY OF THE VERTICILLIUM DISEASES OF PEPPERMINT AND CHRYSANTHEMUM

(Publication No. 19,784)

John Paul Ross, Ph.D.
Cornell University, 1956

The purposes of this investigation were: 1) to examine the possibility of eradicating the fungus Verticillium albo-atrum R. & B. from the vascular system of unrooted cuttings of peppermint, Mentha piperita L. var. Mitcham, and the florists' chrysanthemum, Chrysanthemum morifolium Ram. var. Mary L. Hall; 2) to investigate the effect of an antibiotic, fungichromin, on the soluble amino acids of peppermint cuttings and also on the free and combined amino acids of V. albo-atrum; 3) to compare the composition of the free amino acids of infected and healthy chrysanthemum and peppermint plants.

The chemotherapeutic effectiveness of some 27 materials was tested by allowing solutions of the chemicals to be taken up through the freshly-cut basal ends of cuttings. The cuttings generally were inoculated prior to treatment by allowing the cuttings to take up spores from a spore suspension. To evaluate the effectiveness of the treatments, the cuttings were rooted and grown in the greenhouse and observed for symptoms of the disease and/or reisolations from the vascular tissues were attempted. The antibiotic, fungichromin, and the fungicide, nabam, were found to be the most effective. The chemotherapeutic activity of these 2 materials were not as high as desired, and the results of similar treatments given at different times were quite variable. Although the pathogen was eradicated in some mint cuttings by these materials, it was never eradicated in chrysanthemum cuttings.

It is thought that the lack of chemotherapeutic control encountered in these studies rests in not one but a number of factors all of which may influence the results at one time. These are: 1) accumulation of the toxicant in the leaves rather than at the site of the fungus in the stem; 2) the fungistatic, rather than fungicidal, nature of the toxicant, i.e., nabam; 3) the upward movement and development of the spores of the fungus in the vessels of the cutting; 4) the variability in uptake of toxicant by the vessels.

Paper chromatography was employed for the quantitative determination of amino acids. There were no prominent trends nor consistent differences brought about in the percentage composition of the soluble amino acids of mint cuttings by treatment with fungichromin. However, large increases in the total amino acid nitrogen were detected in the treated cuttings.

Fungichromin at 10 ppm apparently caused the release of all the soluble amino acids of V. albo-atrum into the culture medium. The percentage composition of the bulk protein also was altered significantly with respect to certain amino acids. Although there was no reduction in growth of the fungus, no large alteration in the per cent composition of the protein, and no excessive loss of amino acids into the culture medium when the fungus was exposed to 2 ppm fungichromin, there was a marked change in the relative composition of the free amino acid pool. This change resulted in increases in arginine, lysine and especially proline. The total soluble amino acid content of the fungus in these cultures increased 3-fold.

Comparative studies on the relative amino acid composition of infected and healthy chrysanthemum plants showed that 10 days after inoculation the infected plants differed markedly from the healthy. The change of largest magnitude was an increase in proline content.

Quantitatively, the most evident changes in infected mint plants were found in amide composition. The total amino acid nitrogen of the stems of infected mint plants increased 3 to 6 times above that of the healthy plants. Slight increases in total amino acid nitrogen in infected leaves were also detected.

Pipecolic acid was detected in infected, but not healthy, mint plants. Studies on its origin suggest that it may arise from lysine supplied by the pathogen within the vascular system. 153 pages. $2.05. Mic 57-18

THE EFFECTS OF FRACTIONATED DOSES OF X-RAYS ON DORMANT BARLEY SEEDS

(Publication No. 17,519)

Arnold Bennie Schooler, Ph.D.
State College of Washington, 1956

Experiments were conducted to study the biological effects of continuous vs. fractionated doses of X-ray on dormant barley seeds (Hordeum vulgare var. Himalaya). The effects measured included injury symptoms,

frequency of chromosome aberrations, and frequency of mutations.

Two sets of experiments were conducted in 1954 at 5,000 r and one in 1955 at 15,000 r on continuous and fractionated doses of X-ray. These experiments included 12 treatments on fractionated doses of X-ray with intervals of 30 minutes, 1 hour, 3 hours, 6 hours, 8 hours, 12 hours, 1 day, 2 days, and 4 days. The number of fractionations included 2, 4, and 10 doses.

Injury symptoms included seedling height and field survival. Two of the experiments conducted on seedling height of the fractionated dose experiment indicated significant differences by the F-test. However, by further analysis these significant differences were found doubtful. Only one of the three experiments conducted on field survival indicated a significant difference; the greatest range of variability between replications was found in the two treatments showing the significant difference. Therefore, this significant difference indicated by the F-test is questionable.

A significant difference in the frequency of mutations was indicated by the F-test on one of the three experiments. However, with only one treatment indicating a significant difference, it is questionable if this difference is really true.

The data obtained on fractionated doses of X-rays indicated that the doses of different fractions are additive in producing radiobiological effects in dormant seeds of barley. This interpretation would indicate that no recovery sequence, such as restitution or reunion, takes place before germination in these dormant seeds. It is thought that latent breaks (primary effects), which may be produced by the passage of an ionizing particle, do not become actual breaks until sometime after the embryonic protoplasm becomes hydrated and active metabolism begins.

There was some indication that longer intervals between fractions may be slightly more injurious than a continuous dose. These observations can possibly be explained on the basis of storage effects or effects of some intervening biochemical processes which may produce a secondary effect during the fractionated dose interval.

43 pages. $1.50. Mic 57-19

INHERITANCE OF REACTION TO DIPLODIA ZEAE (SCHW.) LEV. IN ZEA MAYS L. EARS

(Publication No. 18,880)

William James Wiser, Ph.D.
Purdue University, 1956

Major Professors: Herbert H. Kramer and
Arnold J. Ullstrup

The inheritance of diplodia ear rot was studied in 15 groups of progenies which included the single crosses, the F_2 generation, and both backcrosses possible among six inbred lines. All progenies were grown in 1954 and artificially inoculated with a spore suspension of Diplodia zeae by means of a compressed-air sprayer. A severe epiphytotic was induced on susceptible hybrids while more resistant ones remained relatively disease-free.

This study was made on approximately 75 ears of each single cross, 300 ears of the F_2 generation, and 150 ears of each of the backcrosses. Observations made on individual ears included: (a) degree of husk coverage, (b) the time at which the ears turned down, and (c) the amount of disease on each ear. Efforts to determine the reaction of inbreds per se were unsuccessful. Two methods of estimating the reaction of the inbred parents by calculations from progeny performance proved to be unsatisfactory. One other method proved to be fairly satisfactory for estimating inbred reactions which could be more accurately related to progeny reactions. An average of related (by recurrent parent) backcrosses appeared to fit the observed data more closely than other estimates.

An average of the parents (average of related backcrosses) in most instances closely approached the observed percentage of ear rot in the F_2 generation and an average of the two related backcrosses. However, the indicated additive gene action was masked by epistatic gene action in the single crosses involving inbreds varying widely in reaction. The amount of epistasis appeared to be approximately proportional to the difference in reaction. Little or no interaction was evident in crosses between resistant lines.

Correlations of degree of husk cover and time of ear declination with percentage of ear rot were calculated on the individual ear basis. The correlation coefficients revealed that poor husk cover was highly significantly correlated with a high level of ear rot in F_2 progenies in which one or both parent lines were susceptible. No significant correlations were found in progenies having both parents resistant or intermediate. In the backcrosses to Tr and M14 correlations were significant irrespective of the degree of resistance in the opposite parent of the single cross component. Backcrossing to the more resistant parent tended to preclude significant correlations.

Delayed ear declination was associated with a high percentage of ear rot in single crosses between extremely susceptible lines and resistant or intermediate lines. Crosses between very susceptible or between resistant and intermediate lines showed no significant correlations. In segregating F_2 populations, time of ear declination and percentage of ear rot was significantly correlated in every case when Tr or M14 were used as a parent. Similar correlations were less common among crosses of more resistant lines. No definite pattern of correlations between ear declination and ear rot occurred in the backcross progenies. A greater number of backcrosses to the more resistant parent had significant correlations than when the more susceptible line was used as the recurrent parent.

The unusual distributions occurring in all progenies showed few ears with partial infection and many with none or total infection depending upon the reactions of the parents involved. In the progenies with a low incidence of ear rot, the ears that were completely invaded either had insufficient factors for resistance to preclude complete infection or environmental conditions within the ear were sufficiently favorable for the organism to enable the fungus to overcome any physiological resistance. Conversely, the progenies with a high level of ear rot either had enough resistance in some ears to prevent infection, or environmental conditions inside the husks were unfavorable for fungus development. In general, distributions of F_1, F_2, and backcrosses tended to be alike when the inbred parents

were not greatly different in reaction. The effect of a high level of resistance or extreme susceptibility of one of the parents was evident in distributions involving it.

The deficiency of the intermediate classes in the homogenous F_1 progenies suggested that the ear rot percentages were probabilities of infection. Since the same phenomenon occurred in the segregating generations, the ear rot percentages were, also, interpreted as probabilities of infection.

135 pages. $1.80. Mic 57-20

ANATOMY

ELECTRON MICROSCOPY OF THE CENTRAL NERVOUS SYSTEM

(Publication No. 17,181)

Anthony John Darin de Lorenzo, Ph.D.
Washington University, 1956

Chairman: Professor Edward W. Dempsey

The hippocampus and olfactory nerve of adult mice and rabbits were studied with the electron microscope following osmic acid fixation (Dalton, '55) and methacrylate embedding. Identification of structures was established by reference to contiguous thick sections examined under the phase microscope. Pyramidal neurons are characterized by their size, location and cytoplasmic appearance. Their cytoplasm contains irregularly clumped granular ergastoplasm, the classical Nissl substance of the neuron. Mitochondria are numerous and a Golgi apparatus is evident. Myelinated axons of the alveus have also been investigated. The axoplasm of these fibers contains mitochondria, ergastoplasm and numerous fibrils. The axoplasm is bounded by an axolemma approximately 300 angstroms thick. The myelin sheath is composed of myelin lamellae with a periodicity of about 160 angstroms. Small myelinated fibers with diameters of less than one micron have been consistently seen in the alveus. The olfactory nerve is composed of many non-myelinated fibers arranged in fascicles. Each fascicle contains numerous fibers, associated with a Schwann cell. The glomerulus formed by the termination of the fibers on the dendrites of the mitral cells was examined with the electron microscope.

98 pages. $1.50. Mic 57-21

RACIAL, AGE AND REGIONAL DIFFERENCES IN HUMAN SEBACEOUS GLANDS OF THE HEAD AND NECK

(Publication No. 17,188)

Boonanake Kallapravit, Ph.D.
Washington University, 1956

Chairman: Professor E. V. Cowdry

Histological study was made of human sebaceous glands of the skin from ten different regions of the head and neck of white and Negro Americans and of Yellow Siamese, with an age range from stillborn to 73 years of age.

All skin specimens were fixed in Bouin's fluid and stained with hematoxylin and eosin or Mallory's aniline blue collagen stain, or orcein for elastic tissue.

The amount of sebaceous gland per unit area was large in stillborns, was reduced in the 3 and 11 year old subjects, and was increased in 23, 52, 62 and 73 year olds. The amount of sebaceous glands per unit percent area in the stillborn was close to that of the 23-73 age group but the histological structure was different. In the stillborn the basal cells of the sebaceous gland had distinct nuclei; most cells within the substance of the gland showed no nuclei; the outlines of all cells were distinct. In the older age group only some basal cells contain nuclei; the central cells have indistinct outlines and no nuclei. The amount of sebaceous glands varied inversely with the size of hair on the head. The thickness of dermis varied in ten regions of the head and neck and seemed to have no relation to the size of sebaceous glands within it.

The findings suggest further that racial differences in histological structure of sebaceous glands may exist. The cytological picture in the Siamese resembles closely that of the white and Negro stillborns, whereas the adult white and Negro specimens showed evidence generally attributed to aging.

73 pages. $1.50. Mic 57-22

WOMEN AND CULTURE CHANGE: A CASE STUDY OF THE MENOMINI INDIANS

(Publication No. 19,934)

Mary Louise Spindler, Ph.D.
Stanford University, 1956

The problem for the study is: What are the changes that take place in the value orientations, role playing (roles of mother, wife, and social participant) and perceptual structure of Menomini Indian women during the acculturative process? Interrelationships between the three dimensions are analyzed within each acculturative group and between groups. Comparisons are made with Menomini men from data collected by George Spindler where required.

Five levels of acculturation, posited on the basis of religious identification and a number of sociocultural indices, were used to discriminate groups within the sample of females. The acculturative categories are: (1) Native-oriented (all members of the Medicine Lodge and/or Dream Dance group); (2) Peyote Cult (participating members of the cult); (3) Transitional (persons who have participated marginally in both Catholic and native-oriented religious groups); (4) Lower status acculturated (marginal Catholics who had had no religious identification with native religions); (5) Elite acculturated (members who participate regularly in Catholic services and belong to St. Anne's Society).

Ethno-historical data, general information secured from participant-observation, and interview materials from each of sixty-one informants were used. The main body of data for the problem, however, consisted of: sixteen expressive autobiographic interviews, which furnished materials in depth on value orientations and role playing; a sociocultural schedule for each of the sixty-one women which afforded data for relating the women's religious identification with the acculturative continuum posited for the sample and revealed specific overt values; a Rorschach for each woman from which a modal psychogram for the entire sample was made and to which separate group psychograms are assumed to be graphic representations of perceptual structure.

Value orientations of the native-oriented women, which furnish a baseline for analysis, are characterized by dependent attitudes held towards the supernatural, nature, and other persons. The elite women, who represent the end point on the acculturative continuum, display manipulatory attitudes towards nature, the supernatural, and other persons, with strong involvements with achievement and competition. The remaining three groups fall between these two extremes on the continuum; their value orientations are analyzed in terms of the unique combinations and reinterpretations of Menomini or elite acculturated (middle-class American) patterns.

The role playing behaviors of the native-oriented women are latescent in character (dependent upon an outside force for stimuli). In contrast, the elite acculturated women internalize the action patterns of white, middle class women who are originators of action rather than recipients.

The perceptual structure of the entire sample is represented by a modal psychogram. This psychogram is congruent with the group psychogram for the native-oriented women and is represented in all groups except the elite acculturated. This perceptual structure thus indicated is intratensive, with a moderately cautious approach to interpersonal activities and little anxiety. Protocols from the Peyote Cult women and elite acculturated indicate greater responsiveness to environmental stimuli and greater anxiety among the Peyotists.

Female Rorschach protocols reveal fewer tension and anxiety indicators than do those of males, more open emotionality, quicker reactions to outside stimuli, and less involvement with intellectual interests.

Specific relationships between dimensions revealed by the study consist of:

1. The modal (or Menomini) perceptual structure is associated with the expression of specific Menomini values.

2. The two extremes of the acculturative continuum are distinguished by a distinct set of interrelated social, cultural, and psychological attributes.

3. Basic attitudes towards the supernatural are crucial factors in effecting changes in the perceptual structure.

4. The role of social participant is functionally related to perceptual structure. 337 pages. $4.35. Mic 57-23

ARCHITECTURE, CITY AND REGIONAL PLANNING

URBAN FORMATION AND REFORMATION: A DESCRIPTIVE AND CRITICAL ANALYSIS (VOLUMES I AND II)

(Publication No. 17,009)

Saba George Shiber, Ph.D.
Cornell University, 1956

This thesis describes the forms of the contemporary city, investigates forces responsible for their formation and reformation, and deduces some universal principles helpful in guiding the planning and replanning of future urban formations and reformations.

VOLUME I.

Introduction: A brief historical sketch shows urban formation as an expression of changing civilization and culture. Contemporary environmental influences on the expanding scope of urban settlement are examined. With the philosophy that the city is essential to the continuance of civilization, the corollary is expressed that the urban-rural conflict can, and must, be resolved by infusing both with a new architectural esthetic.

Part I. Descriptive Analysis: Prior to analyzing various urban aspects, terminology is proposed describing the physical dimensions of, and phenomena concomitant with locomotion through, the city. The concept of factors which determine urban formation, influence its visual prospect, and engineer its buildup--determinants, modulators, and builders--is delineated. Determinants are composed of static and dynamic factors. Examples of static determinants, among those examined, include physiography, historic formation, and climate. Dynamic determinants form the substance of Part II. Next, urban builders are analyzed in terms of their volumetric contribution to the shelter-envelope of the city. Termed emergents, they include buildings, circulation elements, and accessory circulation structures. Urban buildup is then analyzed for the form incidence of emergents in monolithic and/or contiguous arrangement. The influence of architecture on the forms of emergents is explored against the background of changing human conditions.

Part II. Critical Analysis: Dynamic determinants, varying with people, period, and place, are analyzed. First, contemporary and past planning theories are shown as more reliable if comprehensive, balanced, and proportioned principles, contemporaneously evolved, determine their formulation. Second, the meaning and importance of spatial conceptualization is stressed, and its inherent possibilities for the creation of an urban structure and esthetic are examined in historic, contemporary, and potential perspective. Third, the limitations that kinetic and kinesthetic considerations impose on the architectural foundations of urban formation for perception at varying rates of progression are explored. Fourth, the implications of urban scale are treated, stressing the avoidance of scale clashes. Scale judgment, as in architecture, is proposed for the visual harmonization of urban parts. A concept of urban universals embodies the interaction of static and dynamic determinants effecting formation.

Part III. Critical Synthesis: General and specific influences on over-all urban formation, such as major and minor relocation of uses, are examined in the light of the urban universals, emphasizing the vicissitudes of the Central Business District, industrial trends, and various types of urban reformation. Then follow detailed studies of such selected urban problems as the site, residential areas, shopping centers, neighborhood social foci, industrial zones, and open spaces. That urban forms occur in patterns and/or non-patterns arises naturally from the preceding analyses. Contemporary urban formation is shown to tend towards non-patterned (architectural in contradistinction to architectonic) forms. Since visual perception of the city is stressed, it follows that, for an architectural urban esthetic to avail, urban architects must be thoroughly trained in visual and spatial planning. Finally, significance and symbolism in contemporary urban formation are explained as meaningless, unless their physical manifestations are expressions of social and cultural content.

Conclusion: A theorem of urban formation serves as summation: Given active urban universals, urban formation, and thus urban forms, may be broadly explained, predicted, and designed in direct proportion to the predictability of change, and the mode of incidence of the rational factor.

VOLUME II.

Approximately 670 illustrations complement the text of Volume I and represent an experiment in a comparative visual study of urban aspects.

Volume I: 326 pp.
Volume II: 233 pp. 574 pages. $7.30. Mic 57-24

AN INVESTIGATION OF THE ANTICRYPTOCOCCAL PROPERTIES OF NORMAL SERUMS

(Publication No. 19,673)

William Peter Allen, Ph.D.
University of Michigan, 1956

The purpose of this investigation was to study the effects of serums from non-immunized individuals on the in vitro growth of Cryptococcus neoformans. A normal constituent of serum which could retard or prevent the growth of mycotic pathogens might contribute to the host's resistance to systemic fungal infections.

Fresh serums from normal individuals were prepared and 3 ml aliquots dispensed into culture tubes. An inoculum of actively growing Cryptococcus neoformans, isolate DU, was added to each tube, and the tubes were tightly stoppered to prevent a loss of carbon dioxide and a subsequent alkaline shift in the pH of serum. Some serums were buffered with phosphate buffer to control the pH. The tubes were incubated at 25°C with agitation for varying periods up to six days. Samples were removed from the tubes at intervals and plated on nutrient agar plates to record the survival of this organism. When it was found that human, horse, calf, pig, rabbit, rat, and mouse serums were able to inhibit or suppress the growth of the test organism, and that normal chicken serum exerted a fungicidal action on the organism, further studies of the nature of these properties were initiated.

Comparisons of the effects of different animal serums on the growth of C. neoformans showed that human, horse, calf, pig, and rabbit serums suppressed growth more than did rat and mouse serums. Samples of chicken serum from different chickens were found to vary in the intensity of their fungicidal activity. A suggestion of seasonal variation was also observed. The anticryptococcal effects of mammalian serums and chicken serum were not altered by heating at 56°C for 30 minutes, but chicken serum was inactivated at 59°C for 30 minutes. Serum complement was found to be unnecessary for the inhibitory effects of any of the serums tested. The anticryptococcal factors of these serums were also shown to be largely independent of the effects of pH and reducing agents.

Absorption studies revealed that the fungicidal activity of normal chicken serum for C. neoformans could be removed by 10^6 or more killed cryptococcal or Candida albicans cells per ml of serum but not by Saccharomyces cerevisiae. The inhibitory activity of human serum was unaltered by absorption with killed cells of these three species.

The addition of 1 percent hog gastric mucin to these normal serums completely inactivated their anticryptococcal properties. Heparins did not greatly alter the activity of the serums, but a crude substance of blood group A, derived from hog gastric mucin, had the same inactivating power as crude mucin.

Fractionation of human and chicken serums by 25 to 50 percent saturation with ammonium sulfate yielded a fraction which possessed qualitatively the same type of anticryptococcal activity as did the original serums. Further analysis by paper electrophoresis revealed that this fraction was composed of mostly beta- and gamma-globulins. Cold ethanol fractionation of serum failed to yield an active fraction. Serum lipids were extracted and found to be inactive. The protein nature of the anticryptococcal properties of human and chicken serums was demonstrated by inactivation of the serums following digestion with proteolytic enzymes.

Although in vivo studies were not performed, it was suggested that the presence of the anticryptococcal factors in the serums of normal animals could be of importance in the host's resistance to cryptococcosis.

91 pages. $1.50. Mic 57-25

ANTIBACTERIAL PROPERTIES OF HUMAN UPPER RESPIRATORY SECRETIONS

(Publication No. 19,688)

James Gordon Crawford, Ph.D.
University of Michigan, 1956

This investigation concerned the antibacterial properties of human upper respiratory secretions. The study was divided into two phases: one, the antibacterial properties of the upper respiratory flora; and two, the antibacterial properties of sterilized upper respiratory secretions.

The first phase of study was a determination of the antibiotic properties of the nasal flora. For this purpose the bacteria were isolated from nasal washings and tentatively identified. The antibiotic relationships of the isolated organisms to four selected strains of bacteria were examined by a string-streak technique. The four selected bacteria included strains of Micrococcus pyogenes var. aureus, Streptococcus pyogenes, Diplococcus pneumoniae, and Neisseria catarrhalis. An antibiotic effect was observed as a zone of inhibition at the point of the intersecting culture streaks.

The results of the study in which 60 isolated strains of bacteria were tested indicated that D. pneumoniae inhibited 75 percent of the gram-positive cocci and virtually all of the gram-negative cocci and gram-positive rods which were isolated. The pneumococcus had no inhibitory effect on the gram-negative rods. About 60 percent of the gram-negative rods inhibited D. pneumoniae. Approximately 75 percent of the gram-negative rods and about 25 percent of the gram-positive cocci inhibited N. catarrhalis. M. pyogenes var. aureus and S. pyogenes showed little activity.

The second phase of this study was an investigation of the antibacterial properties of sterilized sinus secretions. Sinus washings from patients believed to have sinusitis were examined for antimicrobial activity.

The multiplication of selected strains of staphylococci media to which nasal washings were added was followed turbidimetrically. In the initial studies it was found that when pooled sinus secretions were added to the culture medium, the multiplication of coagulase-positive staphylococci was markedly inhibited whereas the coagulase-negative staphylococci were not inhibited. Further investigation revealed that the inhibition was due to a significant extension of the lag period of growth, usually from 3 to 6 hours.

In another aspect of this study the antistaphylococcal activity of specimens from patients with acute sinusitis were investigated at several stages of infection. An attempt was then made to correlate the clinical condition of the patient (as reported by Dr. Bruce Proctor of Detroit) with the presence of the antistaphylococcal factor in the secretions.

It was found that patients with clinically infected sinuses produced sinus secretions which were devoid of the antistaphylococcal activity. The patients who had recovered from sinusitis produced the antistaphylococcal factor in their secretions. Specimens taken from patients who had never had a recognized case of sinusitis also contained the antistaphylococcal factor.

The final aspect of this investigation was an analysis of the chemical nature of the antistaphylococcal factor. It was determined that the factor was proteinaceous, and was apparently neither antibody nor lysozyme.

This study indicates the possible importance of two mechanisms of defense in upper respiratory infections. One of these is concerned with bacterial antagonisms in the upper respiratory tract. Disturbances in the ecological balance by such means as indiscriminant use of antibiotics could lead to lowering the patients' resistance to infection. The second defense mechanism is concerned with an antibacterial factor which is apparently specific for coagulase-positive staphylococci. The presence of the active factor in normal and convalescent sinus specimens, and its absence in infected sinus specimens suggests that it is of some significance in the defense of the host. It is possible that inactivation or destruction of the antistaphylococcal activity may aid in initiating sinus infections.

102 pages. $1.50. Mic 57-26

A STUDY OF VIRAL AGENTS ISOLATED FROM THE INTESTINAL TRACTS OF MONKEYS WITH AND WITHOUT DIARRHEAL DISEASE

(Publication No. 19,633)

Warren Ross Hoffert, Ph.D.
University of Pittsburgh, 1956

Chairman: F. S. Cheever

The purpose of this investigation was to study the viral flora of the intestinal tracts of 195 rhesus and cynomolgus monkeys. Emphasis was placed on the examination of specimens from monkeys with diarrheal disease to correlate the presence of viral agents with the occurrence of shigella and diarrheal disease. In addition, antibody studies were conducted employing viral agents isolated and sera obtained from monkeys with and without diarrhea.

Rectal swab specimens were examined for the presence of viral agents by the inoculation of monkey kidney roller tube tissue cultures and suckling mice. Viral agents isolated were divided into two broad groups on the basis of the cytopathogenic effects produced in monkey kidney tissue cultures. By means of the neutralization test technique, nine prototype viruses were recognized in these two groups, and their relationships to members of other known groups of enteric viruses, viz., the polioviruses, the 13 ECHO viruses, the simian viruses, and the Coxsackie viruses, were determined. Cross reactions with the APC (RI) group of viruses were studied by means of the complement-fixation test.

Viruses were recovered in monkey kidney tissue cultures from 85.8 per cent of 176 specimens collected from monkeys with diarrhea and 94.7 per cent of 19 specimens collected from monkeys without diarrhea. These were grouped with rabbit antisera prepared against the prototype viruses. Viral agents were recovered by the inoculation of suckling mice from a total of five per cent of the specimens.

Two of the prototype viruses (M-9 and M-19t) were identified as SV_2 and SV_6 simian viruses, while a third (M-19s) produced signs in suckling mice typical of those described for the Coxsackie group of viruses. Attempts to type this virus with antisera against the five Coxsackie group B viruses and types 1, 2, 3, 4, 5, 8, and 10 group A strains have failed. M-9, M-19s, and M-19t viruses produced cytopathogenic effects similar to those described for the polioviruses in monkey kidney, but produced no cellular damage in HeLa cell tissue cultures. These agents were recovered either alone or in combinations from 31.8, 55.1, and 75.7 per cent of the specimens examined, respectively. M-19s and M-19t were encountered most commonly as mixed isolations. Fifteen isolates which produced similar cytopathogenic effects in monkey kidney tissue cultures could not be neutralized with any combination of pooled antisera prepared against these three viruses.

The remaining six prototype viruses which were recovered infrequently during this study produced cytopathogenic effects similar to those described for the human APC (RI) group of viruses in both monkey kidney and HeLa cell tissue cultures and shared complement-fixing antigens with these agents. One isolate could not be neutralized with any combination of pooled antisera prepared against these latter six agents.

None of the nine prototype agents was pathogenic for adult mice or rabbits, and with the exception of M-19s virus, none of these agents was pathogenic for suckling mice. No lesions were observed following inoculation of the chorioallantoic membranes of developing chick embryos.

Serum specimens drawn from 20 monkeys with diarrhea and 19 monkeys without diarrhea were tested against the prototype viruses. Varying percentages (8-46) of these sera neutralized five of the nine prototype agents.

Shigella isolations were made from 48.9 per cent of the specimens from monkeys with diarrhea. Shigella flexneri 3, 4, and 2 were the predominant types recovered. No shigella were recovered from the specimens collected from normal monkeys.

No correlation could be demonstrated between the recovery of any of the prototype viruses and (a) the recovery of shigella, (b) the occurrence of diarrhea, and (c) the species of monkeys from which they were isolated.

101 pages. $1.50. Mic 57-27

THE INFLUENCE OF PYOCYANIN ON THE INCIDENCE AND TYPE OF BACTEREMIA IN X-IRRADIATED MICE

(Publication No. 19,532)

Robert Elmer McCarthy, Ph.D.
Brown University, 1956

The administration of pyocyanin to BUB mice exposed to midlethal doses of X-irradiation results in a decrease in the incidence of bacteremia. Pyocyanin treatment, however, did not reduce the mortality rate. Animals that died without exhibiting bacteremias were considered to have been killed by the cumulative effects of irradiation and bacterial endotoxin.

Most of the animals that developed bacteremia were invaded by either E. coli or Micrococcus sp. The same organisms were found in increased numbers in the feces of both irradiated and non-irradiated mice following injection of sub-lethal doses of pyocyanin.

Animals exposed to sub-lethal doses of X-irradiation and challenged with Proteus mirabilis strain D were not protected by the administration of either pyocyanin or Pseudomonas aeruginosa. In the course of these experiments it was observed that irradiated mice injected with large numbers of P. mirabilis strain D appeared to be killed by the endotoxin content of the inoculum. Small numbers of living cells did not cause death of irradiated animals.

In connection with the above experiments, selective mediums for the isolation and enumeration of Ps. aeruginosa containing either pyocyanin or cetyltrimethylammonium bromide were investigated. These mediums were found to be inhibitory for Pseudomonas as well as other organisms. The same mediums permitted an amount of growth equivalent to that obtained with other selective mediums generally available, such as SS agar. These investigations suggest that E. coli and Micrococcus sp. were able to produce bacteremias in mice treated with pyocyanin because their growth is not inhibited by the pyocyanin.

53 pages. $1.50. Mic 57-28

AN INVESTIGATION OF THE ALPHA-GLUCOSIDASE OF YEAST DURING DEADAPTATION

(Publication No. 18,642)

Carol Jeannette Johnson Robertson, Ph.D.
University of Michigan, 1956

The amount of certain enzymes present in a cell increases in the presence of chemical substances that stimulate their production (inductors). This process has been termed enzyme induction or adaptation. Conversely, the amount of enzyme decreases when the inductor is removed. This process has been termed enzyme deadaptation. It also has been observed in certain inducible systems that the enzyme activity of intact cells often is less than that of disrupted cells. Before attempting to study the factors influencing the maintenance of enzyme content during deadaptation, the relationship between intact and disrupted cell activities in the absence of inductor required clarification. Therefore, the purpose of this study was to investigate the modification in enzyme content of both intact and disrupted cells during deadaptation of the inducible alpha-glucosidase system in yeast cells.

Saccharomyces cerevisiae strain K, a yeast whose cellular physiology in relation to induced biosynthesis was well defined, was chosen for experimental analysis. The activity of alpha-glucosidase, easily inducible in this organism, was examined in both intact cells and disrupted cells following removal of the inductor in a nitrogen free synthetic medium incorporation 3 per cent glucose as the energy source. Disrupted cells were prepared by either lyophilization, repeated freezing and thawing, or treatment with toluene. The maltase activities of the intact cells were estimated manometrically utilizing 3 per cent maltose as the substrate. The enzyme activities of the disrupted cells were assayed colorimetrically for alpha-phenylglucosidase activity, and manometrically for maltase activity. The latter method involved the fermentation of glucose by the maltose negative yeast, Torula monosa.

During deadaptation of resting suspensions of maltose induced Saccharomyces cerevisiae cells aerobically metabolizing glucose, it was observed that although intact cells rapidly lose their maltase activities following removal of substrate, there was an actual increase in the enzyme content of disrupted cells. During a 180 minute deadaptation, intact cell activities were reduced to 10 per cent of their original value while the activity of the disrupted cells increased 60-80 per cent. The resulting discrepancy between the alpha-glucosidase behavior in intact cells and in disrupted cell preparations appeared first in the late stages of induction. A similar situation was observed in a yeast strain, S. italicus, Y1225, in which only one of the three alpha-glucosidases of strain K was present. There was no parallel rise in basal enzyme activity in disrupted cell preparations of non-induced cells.

A similar increase in alpha-glucosidase activity was demonstrated during aging of disrupted cell suspensions at 4°C for 6 hours. This could also be accomplished in 2 hours at 30°C. The increase in enzyme activity either in vivo or in vitro could not be attributed to de novo enzyme synthesis from amino acids. Conditions known to inhibit such synthesis in yeast had no effect on this phenomenon: (1) UV irradiation, (2) inhibition by amino acid analogues and (3) free amino acid pool depletion. The finding that sonic disintegration released the full complement of unexpressed enzyme indicated that the enzyme had been previously induced. The fact that the release of this enzyme was exclusively associated with the particulate fraction of disrupted cells devoid of free amino acids indicated that the rise involved a release of preformed enzyme from a bound form. Extensive washing of the pellet failed to release the bound enzyme. Neither ribonuclease or desoxyribonuclease effected the release of activity from the pellet indicating that the enzyme was not bound to these cell components. Small amounts of amino acids released in parallel with alpha-glucosidase suggested that the release might involve proteolytic activity. Since lyophilization and repeated freezing and thawing were adequate to release a portion of the enzyme, this binding appeared to be of a loose nature. The discrepancy in activities of the intact and disrupted cells could not be attributed to a change in the alpha-glucosidase pattern during deadaptation.

110 pages. $1.50. Mic 57-29

SOME ASPECTS OF PROTEIN SYNTHESIS IN ABORTIVE BACTERIOPHAGE INFECTION

(Publication No. 19,792)

Harold Leonard Wolin, Ph.D.
Cornell University, 1956

The basic nutritional requirements for Micrococcus lysodeikticus strains ML 1 and ML 53-20 have been determined and found to be identical. Studies extending this information to other strains proved that the basic medium proposed was applicable in all cases.

It has been found that protein, measured as TCA precipitable material, was synthesized in abortively infected cells at approximately the same rate as in productively infected cells but that it remains intact as TCA precipitable material over a greater period of time.

Search for specific virus protein in abortive lysates by means of serological methods did not reveal their presence. These studies yielded preliminary evidence for the existance of a complement fixing antigen in Phage N_1.

Respiration studies carried out on both strains of the organism confirmed the results that have been reported for other phage systems. Phage N_1 when infecting either strain was found to require a longer time to depart from the steady state of respiration than either N_6 or a simultaneous N_6 + N_1 infection. This time period was found to be abnormally long when N_1 infected ML 53-20 cells.

Attempts to reverse abortion by nutritional additives, temperature change or ultra violet irradiation resulted in failure. However, in the attempt to accomplish this end a modification employing ML 1 as host for propagation of N_6 phage has been described.

The results are discussed in the light of a possible theory to explain abortive infection.

60 pages. $1.50. Mic 57-30

PIGMENT CELL BEHAVIOR AND HAIR GROWTH CYCLES: AS INFLUENCED BY GENE SUBSTITUTIONS AND EXPERIMENTALLY INDUCED CHANGES IN THE SKIN OF MICE AND RABBITS

(Publication No. 19,540)

Walter C. Quevedo, Jr., Ph.D.
Brown University, 1956

In mammalian skin, melanocytes are found in the hair follicles, the epidermis, and the dermis. Melanocytes which synthesize pigment are melanotic melanocytes, whereas those which do not are either amelanotic melanocytes, having a genetic block, or precursor melanocytes, having only an environmental inhibition of melanogenic activity. To determine the morphological and physiological similarities of precursor, amelanotic, and melanotic melanocytes these cells were studied in mice and rabbits under normal and experimental conditions.

The Light mouse, excellent for such studies, has hairs which contain clumps of pigment granules, and which are pigmented at the tips but have little or no pigment at the bases. The effect is more pronounced in mice homozygous for $\underline{B}^{lt}$. The basal dilution of pigment is attributed to the disappearance of active melanocytes from the follicles several days prior to the cessation of hair growth. In addition, Light hair follicles contain fewer melanocytes than do those of black mice. Individual pigment granules are the same in both homozygotes and heterozygotes, being round, variable in size, and of the black species of pigment. The $\underline{B}^{lt}$ gene is a deviant black (B) gene influencing only the synthesis and deposition of eumelanin and having no effect on the formation of phaeomelanin. Evidence indicates that the pigment clumps are the result of incorporation of whole melanocytes or fragments during hair growth. The disappearance of the pigment cells at the cessation of melanogenesis suggests that they revert to a rest form. Possibly, however, they are lost and are replaced from a "reservoir" in subsequent hair generations. Hairs of Dark Sepia mice ($\underline{B}^{lt}\underline{bPp}$) contain no clumps of pigment and are pigmented from tip to base. Possibly p reduces the rate of melanin synthesis allowing a more normal performance of the melanocytes in pigment synthesis and deposition.

Greying occurs in both biotin deficient C_{57} Black and Yellow mice. The depigmented melanocytes in the hair follicle resemble the follicular clear cells of albino mice, but they are strongly dopa positive and do supply a few pigment granules to recipient epithelial cells.

Clear cells are as radiosensitive as are melanocytes, both being destroyed by a dose of 1200r of X-rays. Albino follicles lacking clear cells are identical to non-pigmented follicles of white-spotted (Wwss) mice.

Precursor melanocytes of the epidermis in regions of pigmented hair of black-white Dutch rabbits are activated with a single painting of 0.6% methylcholanthrene-in-benzene if hair is growing, but if hair is resting essentially no pigment appears in the basal epidermis until hair growth starts. Apparently the physiological changes which support melanin synthesis by follicular melanocytes also bring epidermal precursor melanocytes to a state close to the threshold of melanogenesis, an additional stimulus at this time being sufficient to transcend the threshold.

65 pages. $1.50. Mic 57-31

THE DEVELOPMENT OF THE SYMPATHETIC GANGLIA, SHEATH CELLS, AND THE MENINGES IN AMPHIBIANS

(Publication No. 19,937)

Edward Lee Triplett, Ph.D.
Stanford University, 1956

The sympathetic ganglia, sheath cells, and spinal meninges were studied in an effort to clarify their embryological history. Reasons for the lack of agreement between workers were believed to be threefold; first of all, the lack of a good method of tagging tissues; secondly, the possibility that these structures may receive contributions from the various progenitors at different times during development; and finally, the possibility that there are differences in the mode of origin of the aympathetic ganglion cells in the different species used by different investigators. Distinct cytological differences were found between the cells of Rana aurora and Hyla regilla, and this difference offered an excellent method of tagging tissues by means of xenoplastic transplantations between these two species. These experimental animals were subjected to several types of operations involving the basal plate or the neural folds, and were fixed at various developmental stages. The time factor was thus taken into consideration. Neural fold deletion experiments on Taricha torosa and the above mentioned species as well as xenoplastic transplantations involving T. torosa were performed to obtain supplementary data.

It is established that the sympathetic ganglia of the amphibians used in these experiments are of dual origin. They originate in part from the neural crest and in part from the basal plate of the spinal cord. It is further shown that the contribution of the neural crest is roughly in inverse proportion to the developmental stage of the animal, whereas the percentage contribution of the basal plate on the other hand is roughly in direct proportion to the developmental stage. The contribution of the neural crest and the basal plate also varies with the species. For instance, in mid-larval stages the sympathetic chains of H. regilla larvae contain about 90 per cent neural crest cell derivatives, while those of T. torosa larvae at similar stages are composed entirely of neural crest cell derivatives.

The sheath cells of the spinal nerves also receive contributions from both the basal plate and the neural crest. As with the sympathetic chains, it was found that in the animals studied the neural crest contribution to the sheath cells varies inversely with the developmental stage of the animal and that as development proceeds the percentage of basal plate cell derivatives among the sheath cells increases. Whereas the sympathetic chains in T. torosa mid-larval animals were entirely of neural crest origin, a small percentage of basal plate derivatives was found among the sheath cells even at this stage.

Similar studies were made on the meninges of the spinal cord. The leptomeninx is composed principally of neural crest cell derivatives and the pachymeninx contains a minority of cells of neural crest origin. I found also that, in contrast to the results with sheath cells and sympathetic ganglia, the percentage of neural crest cells in the meninges remains fairly constant throughout development. The other contributor to the meninges is not well established by these experiments, but it is certain that a very small percentage of the cells comprising the leptomeninx comes from the spinal cord. Although no proof is presented it is probable that those cells that are not derived from the neural crest or the spinal cord are from the mesodermal sclerotome. 65 pages. $1.50. Mic 57-32

FILAMENTOUS AND ATTACHED ALGAE IN SOUTHWESTERN GEORGIA, AND THEIR SIGNIFICANCE AS AN ECOLOGICAL INDICATOR

(Publication No. 19,769)

Robinson Shewell Abbott, Ph.D.
Cornell University, 1956

The study of filamentous and attached algae in Southwestern Georgia was undertaken for the purpose of recording not only the species of these forms in the area, but also of making observations on their relationships to one another and to their environment. The most important affinities between algae and anopheline larvae have been discussed, together with the author's observations in the field, and a review of the more important literature bearing on the subject.

An annotated list of 275 species representing 85 genera is given, which represents collections over several years by the author. All aquatic filamentous and attached forms are included with the exception of the diatoms. The species yielding the largest mass were: Chaetophora incrassata, Batrachospermum spp., Spirogyra spp., Mougeotia spp., Zygnema spp., and Nitella spp. The most abundant forms in numbers of species were: Oedogonium, Bulbochaete, Oscillatoria, Microspora, and Desmidium. To this latter list should probably be added the Zygnemataceae, but most of the material was not found in fruiting condition so that specific identifications could not be made.

The use of algae as indicators of aquatic environments is discussed, and two associations and two single forms are suggested which appear to be significantly unique in their ecological requirements. The symbionts, Zoochlorella and its peritrich partner, represent a single form indicator of temporary flooded areas. Batrachospermum spp., with the exception of B. procarpum and a related undetermined species, are characteristic of cool spring-fed streams. An association of Chaetophora spp., Stigeoclonium spp., Tetraspora lubrica, Draparnaldia spp., and Chaetonema irregulare was found to be characteristic of cypress swamps. All the above indicators seem to reflect the more oligotrophic situation with cool neutral waters as

it exists in the early spring. A second association of the Zygnemataceae, Oedogoniaceae, Microsporaceae, and filamentous Desmidiaceae seems to reflect the more eutrophic and dystrophic situations from spring to fall. In the spring, this second association is confined mostly to open ponds and ditches, but as the season progresses, the streams, cypress swamps, and any flooded areas which have not dried up, either become more eutrophic and contain the moderately acid-tolerant members of this association, or they become more dystrophic and contain the very acid-tolerant members. Field station records indicate that the eutrophic habitats characterized by this second association are the most prolific anopheline breeding situations.

The utilization of algae as food, a provider of protected breeding pools, and as a source of toxic agents are each discussed, citing references to the work of other authors in these fields of study, together with the observations of the author as to their application in Southwestern Georgia swampland. 200 pages. $2.60. Mic 57-33

STUDIES IN THE GENUS SCUTELLINIA

(Publication No. 20,015)

William Clark Denison, Ph.D.
Cornell University, 1956

The genus Scutellinia (Cooke) Lambotte emend. Denison embraces all species of the family Pezizaceae having dark-colored, rooting hairs, red to orange hymenia, and sculptured, guttulate spores. It includes species with spherical spores formerly included in the genus Sphaerospora Sacc. and species with reticulately sculptured spores which have been treated in the genus Melastiza Boud.

Seven species; Scutellinia pseudasperior Denison sp. nov. prov., S. asperrima (Seaver) Denison comb. nov., S. pennsylvanica (Seaver) Denison comb. nov., S. araeospora Denison sp. nov. prov. S. scutellata (L. ex Fr.) Lambotte, S. erinaceus (Schw.) Kuntze, and S. fimetaria (Seaver) Denison comb. nov. are reported from North America.

Isolates from seven collections were nearly identical in cultural behavior. Abundant hyphal anastomoses were formed between all isolates of all collections.

69 pages. $1.50. Mic 57-34

COMPARATIVE ANATOMY OF FIVE SPECIES OF THE FAMILY MENISPERMACEAE

(Publication No. 19,692)

Petronila Chavez Marasigan Dipasupil, Ph.D.
University of Michigan, 1956

The present study is concerned with the anatomy of the foliar organs and the stems of Pycnarrhena manillensis Vidal, Tinomiscium philippinense Diels, Pericampylus incanus Miers, Stephania japonica (Thunb.) Miers, and S. cephalantha Hayata. In the Philippines these plants are important sources of drugs. The purpose of the study is not so much to furnish information pertinent to uses as it is to provide data for phylogenetic considerations and for aid in identification.

The leaves of all the studied species are simple and rather highly specialized with stomata mostly on the lower epidermis and with bifacial mesophyll. Tinomiscium philippinense contains some ramifying sclereids. Multicellular, unbranched hairs are present in the leaves of Tinomiscium philippinense while bicellular hairs characterize Pycnarrhena manillensis and Pericampylus incanus. Stephania japonica and Stephania cephalantha do not have hairs.

Transverse sections of the stems show discrete vaccular bundles comprising an ectophloic dictyostele bounded externally by an undulating band of sclerenchyma and bundle cap fibers. The collateral bundles are separated by persistent broad medullary rays.

All of the species studied show anomalous development of some kind. In Tinomiscium philippinense accessory cambia form layers of secondary tissues outside the original vascular axis. In the other species the continuity of the secondary xylem is interrupted by tangentially placed bands of parenchyma. The vessel arrangement of all species is porous, predominantly solitary in Tinomiscium philippinense and Pycnarrhena manillensis, but in groups of 2 to 8 with 2 and 3 most common in Pericampylus incanus, Stephania japonica and Stephania cephalantha. Round or oval simple perforations occur in transverse rather than oblique ends of the vessel elements in the first two mentioned species. The vessel elements are numerous and mostly short and wide. Tracheids with mostly annular and helical thickenings are present in the primary xylem. Fiber-tracheids dominate over the libriform fibers and wood parenchyma that is mostly diffused occurs as broken bands running tangentially across the xylem in all except in the two species of Stephania where they are grouped and oriented in different directions.

The phloem shows the bundle caps in the outermost part becoming partly transformed into stone cells. In Tinomiscium philippinese and Pycnarrhena manillensis the sieve tubes which are usually accompanied by 2 to 8 companion cells possess more transverse than oblique ends with mostly simple sieve plates containing one sieve area. The other three species contain slightly oblique to oblique ends with 2 to 5 sieve areas in the compound sieve plates. Lattices are present on the lateral walls of the sieve tubes. Elongated secretory sacs containing mostly brownish substances are found in the leaves, cortex, rays, pith and wood of Tinomiscium philippinense but they are found only in the pith, cortex and wood of Pycnarrhena manillensis and only in the mature cortex of Stephania cephalantha.

Basing my interpretations on the established lines of specialization in the structures of secondary tissues the characters that are observed in the five studied species in the family Menispermaceae point to the conclusion that this family is only in a moderate stage of specialization since some features in the secondary xylem and phloem are still primitive. 261 pages. $3.40. Mic 57-35

TEMPERATURE AND NUTRITIONAL STUDIES ON VERTICILLIUM AND FUSARIUM WILTS OF TOMATO

(Publication No. 18,394)

Lloyd Vernon Edgington, Ph.D.
The University of Wisconsin, 1956

Supervisor: Professor L. C. Walker

Studies were conducted with two vascular wilts of tomato (Lycopersicum esculentum Mill.): Verticillium wilt incited by Verticillium albo-atrum Reinke and Berth. and Fusarium wilt incited by Fusarium oxysporum f. lycopersici race 1 (Sacc.) Snyder and Hansen. With the former disease, studies were made on the influence of temperature on (1) growth of the causal organism in culture, (2) the development of disease in tomato plants and (3) internal stem temperature. With the latter disease, the effect of boron calcium, and manganese nutrition on disease severity was investigated.

With Verticillium wilt, growth of the causal organism was dependent on the type of isolate used. Growth rates were determined on Czapek's media at 16°, 20°, 22°, 24°, 28° and 32°C using 5 plates of each of 3 microsclerotial (M-type) and 3 non-microsclerotial (NM-type) isolates. The M-type isolates had an optimum growth rate at 24° and were capable of slight growth at 32°, while the NM-type isolates had an optimum at 22° and failed to survive at 32°.

The influence of temperature on disease severity was studied by growing Bonny Best tomato plants at soil temperatures of 20°, 24° and 28° in each of 4 greenhouses maintained at air temperatures of 16°, 20°, 24° and 28°. This made possible an evaluation of the relative influence of soil and air temperature on disease severity. Four plants were used for each of 2 replicates in each of 2 experiments for 3 NM-type isolates and 1 M-type isolate. Plants were inoculated when 4-5 in. tall by dipping the roots in a spore suspension. The severity of disease was rated 16-19 days after inoculation by a wilt index method. Both isolate types incited severe wilt at 20° and 24°, but only the M-type isolate incited any disease at 28°. Both soil and air temperature had a significant influence on disease severity, with soil temperature being most effective.

The temperature within plant stems was measured at 2, 4, 6, 12, 24, and 30 cm above the soil-line with a copper-nichrome thermocouple. With plants growing in a 20°C soil in a 28° greenhouse, the temperature within the plants stems was influenced predominantly by soil temperature during the day and by air temperature during the night. The influence of soil temperature was correlated with the rate of water-uptake from the soil. As light intensity increased up to 2000 foot-candles, transpiration increased and soil temperature became more effective in controlling internal stem temperature.

With Fusarium wilt, using a sand-drip system for supplying nutrients, a decrease in either boron or calcium caused an increase in susceptibility of tomato plants. When boron was increased to 10 ppm to give toxicity symptoms, wilt became more severe than when plants were supplied with 0.05 ppm boron, the amount required for optimal plant growth.

Using a water culture system, a method of inoculation was developed which could be used for study with other trace elements. Using this method, a single experiment indicated that either a deficiency or excess of manganese supplied to tomato plants increased susceptibility to disease. 61 pages. $1.50. Mic 57-36

CYTOLOGICAL AND INTERSPECIFIC HYBRIDIZATION STUDIES IN THE GENUS VIBURNUM

(Publication No. 20,017)

Donald Roy Egolf, Ph.D.
Cornell University, 1956

The genus Viburnum includes many ornamental species with diverse ornamental attribues. The goal of interspecific hybridization in viburnums is to combine in one plant several of the ornamental characters from different species. A cytological study was undertaken to supplement and establish a basis for a long range breeding program.

An extensive Viburnum collection of species and varieties which were obtained as seed, cuttings and plants from botanic gardens, arboretums, nurseries and native habits, was assembled for the study.

The method of hybridization was discussed. Eighty-six of the 273 attempted interspecific crosses, which involved twenty-nine species and two hybrids, produced seed. Most of the seed produced consisted of empty seed coats or partially developed seed with little or no endosperm, and a partially developed embryo. A greater percentage of sib-pollinations than self-pollinations produced seed. The eight interspecific crosses that yielded mature normal seed involved taxonomically allied species. Both reciprocal interspecific crosses produced viable seed in only five crosses.

The majority of the 1007 interspecific hybrid seedlings were produced from the seed by embryo culture techniques in eight to ten weeks. The addition of sixty parts per million adenine sulfate to the culture medium stimulated immature and partially developed embryos to develop into plants. The plants grown by embryo culture, at 70°F temperature and under additional light, produced plants in one year comparable in size with three year nursery grown plants. Interspecific hybrids have been produced from crosses between species from different taxonomic sections of the genus and between species from different geographical regions.

The somatic chromosome counts were determined from acetic-orcein smears for seventy-eight species, sixty-three varieties, nine hybrids, and five unidentified species. Within the genus chromosome complements of 16, 18, 20, 22, 32, 40, and 72 were determined with 18 being the most frequent. The basic chromosome numbers for the genus are eight and nine. Of the sixty-three varieties only two were located that had different chromosome counts from the species. Two triploids, V. lobophyllum and V. lantana var. rugosum, and two tetraploids, V. ovatifolium and V. molle, that do not appear morphologically different from the diploid were located. Diploid plants were found of V. sieboldii and V. setigerum which otherwise are tetraploid species. V. plicatum and V. plicatum f. tomentosum are represented by 2n=16 and 2n=18 forms. In V. plicatum f. tomentosum it is only the 2n=16 form which produced abundant fruit. Three cytotaxonomic complexes, V. carlesii 2n=18,20,22; V. odoratissimum 2n=32,40; and V.

dentatum-V. pubescens 2n=36,72 were uncovered which will require more extensive study to resolve.

The genus can be subdivided into four geographical centers of distribution -- Asia, Europe, North America, and Central America. The basic number n=8 is believed to be the most primitive and is restricted to the Asian center of distribution. The basic number n=9 is more frequent and is found in species from all the geographical centers of distribution. The evolutionary trend within the genus appears to have been $16 \rightarrow 18 \rightarrow \begin{matrix} \nearrow 32 \\ \rightarrow 36 \end{matrix} \rightarrow 72$ chromosome complements. The phylogenetic tree has two main divergent branches; one from the basic number n=8 and the other from the basic number n=9. The indications to date are that Asia is the center of origin of the genus

The present study provides a basis for plant breeding and cytological studies to be continued in the genus Viburnum.

144 pages. $1.90. Mic 57-37

ADAPTIVE ASPECTS OF GLUCOSE METABOLISM IN BAKER'S YEAST

(Publication No. 19,709)

Aristid Lindenmayer, Ph.D.
University of Michigan, 1956

Micro-organisms exhibit a wide range of adaptive responses to their environment. Even a vital process like carbohydrate metabolism has been shown to be subject to such changes, some of which were investigated in this work. In addition, the induced biosynthesis of the enzymes involved in these adaptations were also studied.

Four adaptive phenomena were investigated concerning glucose metabolism in Strain LK2G12 of Saccharomyces cerevisiae.

1. The respiratory rate, as measured by the O_2 uptake, shows considerable increase when cells are aerated in a sugar solution, or when an aerobic culture progresses from the logarithmic to the stationary phase. These increases occur in the presence of a carbon source under non-growing conditions, and are accompanied by a rise in the cellular levels of the cytochromes a, b and c, as well as of cytochrome oxidase.

2. The fermentative rates, as measured by the CO_2 production under aerobic and anaerobic conditions, were found to decrease when the cells were aerated in the absence of a carbon and a nitrogen source. The decline is particularly great in anaerobically grown cells.

3. The Pasteur effect of yeast cells also shows adaptive changes. The Meyerhof Quotient of aerobically grown cells is about 2, while that of anaerobically grown cells is 4-6 with a low rate of O_2 uptake. When such anaerobic cells are starved for at least 3 hours in air, the Meyerhof Quotient becomes zero and the respiratory rate is further lowered. The "normal" Pasteur effect, i.e., a Meyerhof Quotient of 2, is connected with the presence of cytochromes a, b and c.

4. When anaerobically grown cells are exposed to O_2, a respiratory adaptation can be observed. The rate of O_2 uptake and the levels of cytochromes b and c increase according to first order kinetics, while the rise in cytochrome oxidase activity occurs according to an S-shaped curve. Anaerobically grown cells show the spectral bands of cytochromes a_1 and b_1, at 555-60 and 580-90 mμ. respectively. In rapidly growing anaerobic cultures, which are supplemented with the anaerobic growth factors ergosterol and oleic acid, the a_1 and b_1 bands are weak, while under conditions of retarded growth their intensity increases. After 16 hours of starvation these bands disappear, resulting in cells devoid of all absorption bands in the green to red region. The intensity of the absorption peaks was measured by a spectrophotographic method worked out for this purpose.

Cells of different physiological types were used for determinations of endogenous respiration and fermentation, of the rate of glucose uptake, as well as of the effect of some metabolic poisons, and of ultraviolet irradiation. The metabolic rates of different cell types were studied as functions of the glucose concentration, and Michaelis constants were calculated. The stimulatory effect of yeast extract on fermentation was also investigated.

Thus it was shown that the atmosphere, the age of the culture and the availability of nutrients influence the physiology and the enzymatic constitution of yeast. More specifically, the role of the cytochromes in some of the adaptive changes was clarified. Information was obtained pertinent to the biosynthesis of the "aerobic" cytochromes, a, b and c, with special reference to the part played by the "anaerobic" cytochromes, a_1 and b_1.

185 pages. $2.45. Mic 57-38

VARIATION IN SORGHUM VULGARE VAR. DRUMMONDII (Steud.) Chiov.

(Publication No. 17,194)

Bernard Carl Mikula, Ph.D.
Washington University, 1956

Chairman: Edgar Anderson

The annual weed sorghums have been a serious pest of cultivated fields for over 75 years yet little is known of its variation and origin as a weed. This study of weed sorghums required the discovery of its distribution, accumulation of field records, analysis and comparison of variation under controlled conditions and development of methods for analysis of weeds.

Syrup sorghum cultivation was widespread through the United States after 1854. Areas with high syrup production in 1880 are found to have weed sorghums established in corn fields at the present time. Weed sorghums were also found to be morphologically related to sorghums cultivated in Europe for over 1700 years and introduced to this country (especially broom corn) before the syrup sorghums.

Distribution of weed sorghums along the Ohio-Wabash, Illinois and upper Mississippi River Valleys is mapped and described. Frequency of weed sorghums was found to vary greatly from year to year, subject to local field conditions. Cross cultivation was found to be the most effective control method in fields overrun with weed sorghums. Black glumes enclosing the seed and borne on open panicles are widely distributed and are believed to be the result of natural selection since the opposite

conditions are characteristic of many cultivated varieties.

Variation in weed sorghums of the Ohio and Wabash Valleys, grown in an experimental plot, is analysed by a study of internode patterns. Heterogeneity in internode patterns both within and between progeny groups raised from seed of a single inflorescence was found for ten localities studied. Four major internode pattern groups were found. Progeny groups were classified as showing mostly unimodal or bimodal internode patterns.

Variation was analysed by the use of scatter diagrams based on comparisons of stem thickness, inflorescence length, number of tillers, number of nodes, number of branches in the terminal plume, and the number of branches in the inflorescence. Two complexes with broom and syrup sorghum affinities are pointed out. Two groups were also noted for time-to-maturity.

Among the ten localities compared, complexes delimited by the internode diagram patterns, scatter diagram characters and time to maturity, are made up of the plants representing the same localities for each of the three methods of analysis. It is concluded that the heterogeneity of the weed sorghums reflects their origin as hybrid complexes derived from the syrup and broom sorghums.

78 pages. $1.50. Mic 57-39

A CYTOTAXONOMIC STUDY OF THE GENUS ZIGADENUS (LILIACEAE)

(Publication No. 17,517)

Sherman J. Preece, Jr., Ph.D.
State College of Washington, 1956

This study deals with relationships of the taxa belonging to the genus Zigadenus and also the relationship of Zigadenus to other genera of the tribe Veratreae (Amianthium, Melanthium, Schoenocaulon, Stenanthium and Veratrum). Methods used involved morphological studies of about 6,000 herbarium specimens, chromosomal studies, uniform garden cultures, and investigations of geographic distribution and ecology.

The genus Zigadenus is accepted in the broad traditional sense, and the following taxa within the genus are given nomenclatural recognition:

ZIGADENUS Michx.

Section I. EUZIGADENUS Baker
1. Z. glaberrimus Michx.

Section II. OCEANOROS (Small) Preece, stat. ined.
2. Z. densus (Desr.) Fernald
3. Z. leimanthoides Gray

Section III. CHITONIA (Salisb.) Baker
4a. Z. venenosus Wats., var. venenosus
4b. Z. venenosus var. gramineus (Rydb.) Walsh ex Peck
4c. Z. venenosus var. micranthus (Eastw.) Jeps.
4d. Z. venenosus var. fontanus (Eastw.) Preece, comb. ined.
5a. Z. fremontii (Torr.) Torr. ex Wats., var. fremontii
5b. Z. fremontii var. minor Torr. ex Baker
6. Z. brevibracteatus (Jones) Hall
7. Z. paniculatus (Nutt.) Wats.
8. Z. exaltatus Eastw.
9. Z. nuttallii Gray ex Wats.

Section IV. ANTICLEA (Kunth) Bentham
10a. Z. elegans Pursh, var. elegans
10b. Z. elegans var. glaucus (Nutt.) Preece, comb. ined.
11. Z. virescens (HBK) Macbride
12. Z. vaginatus (Rydb.) Macbride
13. Z. volcanicus Benth.
14. Z. sibiricus (L.) Gray ex Wats.
15. Z. makinoanus Miyabe & Kudo

There is considerable question as to whether Zigadenus as traditionally delimited forms a natural unit. The sections, however, appear to be composed of taxa which definitely belong together. The criteria used to distinguish these sections and the possible relationships of each with other genera follow:

Section I, EUZIGADENUS, is distinguished by the presence of tortuous, horizontal rhizomes and paired glands at the base of each perianth segment. It includes only Z. glaberrimus which is distributed from Virginia through the Carolinas and Georgia to Florida, Alabama and Mississippi. The chromosome number $2n = 52$ is reported provisionally. This section is strikingly distinct from other sections of the genus and from other genera of the tribe.

Section II, OCEANOROS, is recognized by its slender bulbs, dense inflorescences and single, ovate, obscure gland at base of each perianth segment. It includes two species, distributed from New York southward to Florida and westward to eastern Texas. No chromosome counts were made. Similarities in morphology indicate a possible close relationship between this section and the genus Amianthium.

Section III, CHITONIA, is distinguished by its ovoid bulbs, open inflorescences and single, ovate, definite gland at the base of each perianth segment. It includes six species and four varieities, distributed from British Columbia eastward to Saskatchewan, southward to Texas, and westward to Baja California, but best represented in northern California. Chromosome numbers $n = 11$ and $2n = 22$ are reported. This section is distinct from other sections of the genus and from other genera of the tribe.

Section IV, ANTICLEA, includes those species with ovoid bulbs, single, bilobed, definite gland at the base of each perianth segment, and partially inferior ovary. It includes six species and one variety, distributed from Siberia, northern China and northern Japan to Alaska, eastward to the Gaspé Peninsula, and southward to Guatemala. The chromosome number $n = 16$ is reported. Chromosomal evidence as well as similarities in certain aspects of morphology indicate a possible relationship with the genera Veratrum and Stenanthium (Stenanthella) of tribe Veratreae.

Chromosome counts for other members of the Veratreae reported are: Amianthium muscaetoxicum, $n = 16$;

Schoenocaulon drummondii, n = 8; Schoenocaulon texanum, n = 8; Stenanthium occidentale, n = 8; and Veratrum parviflorum, n = 8.

172 pages. $2.25. Mic 57-40

A REVISION OF RAUVOLFIA WITH PARTICULAR REFERENCE TO THE AMERICAN SPECIES

(Publication No. 17,199)

Aragula Sathyanarayana Rao, Ph.D.
Washington University, 1956

Chairman: Robert E. Woodson, Jr.

Rauvolfia, an apocynaceous genus, has not been taxonomically studied for a long time. An essay on the American Rauvolfias published by Markgraf in 1924, has needed revision. A prospectus for the genus, by Pichon, in which he estimated about 110 species for the world, has been based on insufficient study. Further the recent discovery of valuable alkaloids in several Rauvolfia species has enlarged interest in these plants to a wider nonbotanical public.

This study is based on an examination of more than 2,000 herbarium specimens from 16 important herbaria of the world and on observations of living plants of four species grown in the greenhouse. The American species have received particular attention; the rest of the species have been studied comparatively for elucidating the phylogeny. Two American species, with a complex synonymy, due to their polymorphic nature, have been statistically analyzed with respect to variation in certain measurable characters, and the synonymy resolved.

This account recognizes 9 sections for the genus. The 33 American species are distributed under four series, one, with three subseries, together comprising two sections. One new species has been described. The account includes a discussion of the geography of the genus, with distribution maps, and the interrelationships of the species. An analytical key to the sections is provided; further keys to all the American species and illustrations to all but one, are also given. 215 pages. $2.80. Mic 57-41

PLANT ECOLOGY OF A BOG IN NORTHERN IDAHO

(Publication No. 17,518)

John Hamilton Rumely, Ph.D.
State College of Washington, 1956

An investigation of the plant ecology of a pond and associated organic deposits in the cedar-hemlock forest region of northern Idaho has provided information about postglacial and recent vegetation, peat stratigraphy and pollen statistics. Palynological analyses revealed a postglacial regional vegetational and climatic sequence from an initial cool-moist period, through a relatively warm-dry period, to a second cool-moist period, with forest succession severely interrupted at least once by fire. Vegetational analyses provided a quantitative basis for the delimitation of zones of typical hydrarch succession about most of the pond margin. At one end, a shore-anchored sphagnum-bog mat of relatively recent origin extends partially into the pond. The topo-edaphic climax vegetation on the organic deposits is considered to be a thicket dominated by Spiraea douglasii var. menziesii. Examination of the peat stratigraphy along a transect across the basin revealed the existence of two distinct depressions, each with an individual although related developmental history. Two layers of volcanic ash were encountered in the bog deposits; the palynological analyses indicated a correlation of the lower one with similar layers in other peat deposits of the region, recently dated by the radiocarbon method as having been deposited about 6,750 years ago. The present seasonal pollen precipitation into the area was charted, the results showing that pollen of most taxa is not disseminated any great distance from its source. Applications of size-frequency distributions in the identification of modern and fossil pollen of five northwestern pines indicated that the method is a helpful, although not positive, means of distinguishing among the taxa. The results of the analyses are discussed with relation to the developmental history of the area.

93 pages. $1.50. Mic 57-42

CONTROL OF LOOSE SMUT OF BARLEY BY WATER SOAK AND CHEMICAL METHODS

(Publication No. 17,835)

Indra Narain Tandon, Ph.D.
Kansas State College, 1956

Brown loose smut of barley caused by Ustilago nuda (Jens.) Rostr. is a destructive disease and appears in all the barley growing regions of the world. During the last several years average losses due to this disease have been more than five percent in Kansas. The disease may be controlled by the modified hot water treatment of the seed which is practiced only to a limited extent by the farmers because of its complicated nature and the serious effect on the germination of the seed. Successful control of this disease has been obtained during the last five years by soaking seed in water or in a suspension of Spergon.

The object of the present investigations was to study some of the factors involved in the control of loose smut by chemical and water-soak methods and to devise, if possible, a practical method for the effective control of loose smut without any serious injury to the germination of the seed.

The experiments were conducted with winter as well as spring barley varieties, with seed naturally infected with loose smut. The treatments included were soaking in water and in a suspension or solution of Spergon-SL, Vancide 51, and Panogen 15, and the hot water treatment. The control of loose smut by the anaerobic method also was tried.

All the experiments were run in the field using a randomized block design. Data were obtained on emergence, control of brown loose smut, and yield, and analyzed statistically.

The water-soak and the chemical treatments entail soaking the infected seed for relatively long periods of

time. A relationship was found between the temperature and the time required to secure the control of smut. The higher the temperature, the shorter was the time required to obtain the desired results. No effective control of the disease was obtained at 48° F. or below even by eight days' soaking.

The quantity of solution used in soaking the seeds made no difference in the control of smut. In most cases, however, the emergence was higher with the greater amount of water used.

The concentration of the chemicals used was important. Although the smut was controlled at all the concentrations of the chemicals used with a proper adjustment of temperature and duration of soaking, the emergence was reduced greatly at higher concentrations. Spergon at 0.1 percent had a very deleterious effect on the emergence and was unsuitable. Effective control of brown loose smut was obtained by soaking the seeds for 56 hours at 75° F. in water, 0.2 percent Vancide, and 0.01 percent Panogen, and also by 40 hours' soaking at 80° F. in water and 0.2 percent Vancide. The water-soak treatments reduced the emergence as well as the yield more often than 0.2 percent Vancide. No reduction in emergence was observed with 0.01 percent Panogen. In general, the soaking treatments did not result in as great a reduction in emergence as was caused by the hot water treatment.

The anaerobic treatment, which consisted of soaking the seed for two hours in water and then holding the soaked seed in an airtight container, gave better results than the water-soak treatment. Complete control of smut was obtained by treating for 48 hours at 80° F. with no significant reduction in emergence.

It may be concluded that the anaerobic treatment carried out at 80° F. for 40 hours as well as 56 hours' soaking at 75° F. in 0.2 percent Vancide and 0.01 percent Panogen are some of the most promising treatments for the effective control of loose smut of barley.

91 pages. $1.50. Mic 57-43

CHEMISTRY, ANALYTICAL

A STUDY OF NEUTRON ABSORPTIOMETRY AND ITS APPLICATION TO THE DETERMINATION OF BORON

(Publication No. 19,552)

Robert Steven Braman, Ph.D.
Northwestern University, 1956

The theory and practice of neutron absorptiometry have for the first time been thoroughly investigated, and the applicability of the method for the precise determination of boron has been established.

The best general purpose apparatus for use with this method consists of a paraffin moderator one foot square by six inches high with a six inch boron trifluoride neutron counter tube surrounded by an annular sample cell placed along the vertical axis. An adequate neutron flux is provided by a ten millicurie radium-beryllium source placed midway between the top and bottom of the moderator and as close to the sample cell as possible. For best results the counter tube should be filled to a pressure of 120 centimeters of mercury; the filling should be enriched in the boron-10 isotope. The sample cell, which should extend through the full height of the moderator and which should be filled to a level slightly above the top of the moderator, may have any desired volume between 25 and 250 milliliters to accomodate samples of different concentrations. Slightly better results are obtained when small sample cells and relatively concentrated solutions are used. A sample cell consisting of a helical coil of tubing wound around the counter tube may also be used; this type of cell permits application of the method to the continuous monitoring of process streams. The sample cells should be constructed from materials which have very low neutron absorption cross sections.

The concentration of boron in the sample solution is related to the number of counts recorded in a fixed counting period by the relationship

$$C = C_0 \frac{N_0 - N}{N - n}$$

where C is the concentration, N_0 is the number of counts with pure solvent in the sample cell, N is the number of counts with sample solution in the cell, and C_0 and n are arbitrary constants. From this equation and the theory of counting errors it has been possible to predict analytical errors and to establish the optimum conditions for analysis. For best results the sample should contain about 1.0 gram of boron; the precision which can be achieved if a ten-minute counting period is employed then is about $\pm$ 0.2%, although the precision is not extremely seriously impaired if the sample contains as little as 0.1 or as much as 10.0 grams of boron. The error in determining small amounts of boron is about $\pm$ 0.7 milligrams. Standard deviations are inversely proportional to the length of the counting period, and hence precision can be improved by employing longer counting periods.

It has been shown that small fluctuations in temperature and that coincidence counting errors of as much as 10% have no effect as far as practical application of the method for analytical purposes is concerned.

Neutron absorptiometry is a particularly convenient method for the determination of boron since the other elements most frequently associated with boron do not interfere, and hence separations are seldom required. The method is non-destructive and the state of chemical combination is immaterial; the only sample preparation required is dissolution in a suitable solvent. The results obtained depend slightly on the solvent used; the same solvent must be used for both calibration and analysis. The only serious disadvantages of the method are the low sensitivity and the requirement that relatively large samples must be used in order to realize the highest precision. 174 pages. $2.30. Mic 57-44

CHEMISTRY, BIOLOGICAL

SOME ASPECTS OF THE ROLE OF VALINE IN PENICILLIN BIOSYNTHESIS

(Publication No. 17,504)

Chester Wallace De Long, Ph.D.
State College of Washington, 1956

Reported here are studies of the incorporation of C^{14} into penicillin, using short periods (1-18 hours) of fermentation after addition of DL-, D-, or L-valine-1-C^{14} to Penicillium cultures. Results are given also for studies of short-term incorporation of C^{14} from acetate-1-C^{14} into penicillin in the presence and in the absence of added L-valine.

The rate of incorporation of D-valine is shown to be characterized by a lag period as compared with rapid incorporation for L-valine and L-cystine. In the presence of L-valine, the uptake of added D-valine-1-C^{14} into penicillin is markedly depressed. The observations that Penicillium cultures apparently do not adapt to D-valine and that D-valine-1-C^{14} is converted in the mycelium to L-valine-1-C^{14} support the suggestion that D-valine is not a direct precursor of penicillin.

Although L-valine, like L-cystine, is incorporated into penicillin rapidly with no lag period, penicillin derived from L-valine reaches a maximum of approximately 50 per cent of that formed during the experimental period, and evidence is adduced to suggest that this might reflect endogenous synthesis of L-valine.

Competitive utilization experiments show that β-hydroxy-DL-valine, α-ketoisovaleric acid, α,β-dihydroxyisovaleric acid, and β,β-dimethylacrylic acid do not compete effectively with valine in penicillin biosynthesis.

Acetate-1-C^{14} is incorporated slowly into penicillin, with about 80 to 90 per cent of the incorporated C^{14} found

in the penicillin lactam carbonyl carbon, and about 20 per cent, in the carboxyl carbon. Mycelial valine formed from added acetate-1-C^{14} has 75 per cent of its C^{14} in the carboxyl group.

Since this work serves to establish the close relationship between L-valine and penicillin biosynthesis, it seems reasonable to expect that further research with this compound might lead to further clarification of penicillin biosynthesis. 61 pages. $1.50. Mic 57-45

CAROTENE CONTENT AND LIPOXIDASE ACTIVITY OF ALFALFA AT VARIOUS STAGES OF GROWTH (PARTS I-III)

(Publication No. 18,843)

Jack Rowland Durst, Ph.D.
Purdue University, 1956

Major Professor: S. M. Hauge

Growing alfalfa is very high in carotene but during the conventional field-curing process, 45-90% of the carotene may be lost. This great loss of carotene has been ascribed to an oxidative process catalyzed by enzymes and light. Evidence has been presented that the carotene destroying enzyme in alfalfa is a lipoxidase. An investigation was conducted: to develop a method for determining the lipoxidase activity of alfalfa in a controlled and reproducible manner; to determine the carotene concentration and lipoxidase activity of various tissues of alfalfa of different stages of maturity collected through the growing season; and to partially characterize the alfalfa lipoxidase.

Attempts were made to inactivate the carotene destroying enzyme system in alfalfa in the field by open-flame heating. No significant improvement of the preservation of carotene was found during field-curing. However, incubation studies indicated that the enzyme was partially inactivated by the flaming. The loss of carotene was thought to be caused by an increased photochemical destruction after the enzyme had been inactivated. It was found that in the fall both flamed and unflamed field-cured alfalfa hays contained adequate amounts of carotene.

An assay for determining the lipoxidase activity in alfalfa was developed and perfected. The lipoxidase was removed from the alfalfa by a low-temperature, two-immiscible phase extraction (chloroform-sodium sulfite mixture), purified by precipitation with ammonium sulfate and the activity measured by rate of decolorization of the carotenoid, bixin. This method gave accurate and reproducible values.

The temperature optimum of alfalfa lipoxidase as measured by the rate of decolorization of bixin was found to be 31.5° C. No dialyzable co-enzyme was found for alfalfa lipoxidase.

The influence of inhibitors on alfalfa and soybean lipoxidase was determined by three different methods, bixin decolorization, peroxide formation and oxygen uptake. Similar inhibition took place in the bixin decolorization and oxygen uptake methods for both alfalfa and soybean lipoxidase. Cyanide inhibited both alfalfa and soybean lipoxidase in the bixin decolorization and oxygen uptake methods but not in the peroxide formation method. Alfalfa and soybean lipoxidase were shown to be similar by the inhibitor studies, the similarities in temperature optimum and the finding of no dialyzable co-enzyme.

A sampling technique was developed for the collection of alfalfa samples. This technique permitted collection of alfalfa at various stages of growth on the same date, thus minimizing the effects of variations in climatic conditions, and facilitated the processing of the alfalfa by preventing wilting.

In luxuriantly growing alfalfa the carotene concentration of the leaves, at a given sampling time, was found to be the same regardless of the stage of maturity with the exception of early growth alfalfa. The carotene concentration of the whole plants decreased with bloom stage. An over-all increase in carotene concentration of the alfalfa was found as the season progressed. Changing climatic conditions affected the carotene concentration.

A decrease in the percent of leaves of the whole plant and a corresponding increase in stems and flowers were found as the alfalfa matures. While, as the season progressed the percentage of leaves increased and the stems decreased.

The lipoxidase activity of the leaves of early growth alfalfa was about three times that of the leaves of full-bloom alfalfa but in contrast the lipoxidase activity of the flowers was about four times that of the leaves of early growth alfalfa. The lipoxidase activity decreased as the season progressed. An inverse relationship was found between carotene concentration and lipoxidase activity. This relationship may indicate a possible role of lipoxidase in alfalfa. 72 pages. $1.50. Mic 57-46

THE EFFECT OF AMINO ACID ANALOGS ON PROTEIN METABOLISM: I. SYNTHESIS OF DL-β,β-DIETHYLALANINE AND ASSAY OF ITS EFFECT ON RAT GROWTH AND LIVER COMPOSITION. II. STUDY OF ALTERATIONS IN RAT PLASMA PROTEIN FRACTIONS INDUCED BY ETHIONINE ADMINISTRATION.

(Publication No. 19,695)

John Vincent Fopeano, Jr., Ph.D.
University of Michigan, 1955

Protein metabolism in rats has been studied following the administration of two amino acid analogs. In preliminary experiments, DL-β,β-diethylalanine (DL-DEA), an analog of the branched chain amino acids which had not been previously tested as an antagonist, failed to inhibit growth. However, feeding DL-DEA at the higher of two levels resulted in a lower liver lipide and a higher liver water and protein content than in controls. The differences found were small but statistically significant.

The major portion of the experimental work has been concerned with the effects of administration of DL-ethionine on the metabolism of plasma protein. Feeding DL-ethionine to male rats resulted in a normal or lower total plasma protein concentration. Analysis of the plasma protein by salt fractionation and electrophoresis indicated an increased plasma albumin-globulin concentration ratio in male rats to which ethionine was administered. This increase was due to a decrease in α_1-globulin and to an increase in albumin.

Male rats, fed a diet containing DL-ethionine, were injected with S^{35}-L-cystine and were sacrificed at intervals thereafter. A comparison was made of the albumin-globulin specific activity ratio as a function of the time elapsed between the injection of isotope and removal of the blood sample. The results obtained showed no significant differences from those obtained from rats on a control diet or rats on a control diet but injected with a single dose of ethionine at the time of administration of the isotope. However, in each case, the albumin-globulin specific activity ratio increased with time, indicating a faster turnover of globulin than of albumin.

In another series of experiments, rats were given ethionine by stomach tube. S^{35}-L-cystine was administered to these rats and to starved as well as fed control rats. Four or five samples of blood were drawn from each rat by heart puncture and a total plasma protein turnover curve for each rat was constructed. Again no consistent differences in the turnover rates of the total protein of ethionine treated rats as compared with controls could be detected. However, in every case, the standard specific activity of the total plasma proteins of ethionine treated rats was higher than controls. Urinary excretion of S^{35} by an ethionine treated rat was normal or above.

On the basis of these and other experiments, it is suggested that an initial decrease in α_1-globulin concentration results in a transient lowering of the osmotic pressure of the extracellular fluid which is partially compensated by a redistribution of body fluid. It is further postulated that as a consequence, the plasma amino acid concentration and the excretion of S^{35} are increased. This would produce a decrease in the body pool of free cystine to account for the higher labeling of the protein in the ethionine treated rats.

Such an interpreation does not contradict the results of other investigations but does point out factors which have not previously been considered.

150 pages. $2.00. Mic 57-47

I: PURIFICATION AND PROPERTIES OF D-GLUCOSE-6-PHOSPHATE DEHYDROGENASE. II: THE ENZYMATIC SYNTHESIS OF HYALURONIC ACID.

(Publication No. 17,186)

Luis Glaser, Ph.D.
Washington University, 1956

Chairman: David H. Brown

I. The enzyme, glucose-6-phosphate dehydrogenase, has been purified from an autolysate of brewers yeast. A 600- to 900-fold purification was obtained in 20 per cent overall yield. The final preparation has a "turnover number" of 12,000 moles of substrate per 10^5 gm. of enzyme per minute at pH 8.0 and 25° C and is free of 6-phosphogluconic acid dehydrogenase, phosphohexoseisomerase and phosphoglucomutase, but contains a small amount of hexokinase. Steps for the removal of hexokinase by precipitation of glucose-6-phosphate dehydrogenase with ribonucleic acid are described.

The purification of the enzyme is accomplished by removal of the nucleic acid in the autolysate with protamine, ammonium sulfate fractionation, adsorption of the enzyme on calcium phosphate gel, alcohol fractionation, adsorption on alumina C_γ gel, and chromatography on a starch-celite column.

The effect of pH, temperature, salt concentration, and various inhibitors has been studied. The Michaelis constant for glucose-6-phosphate has been found to be 6.9×10^{-5} and that for triphosphopyridine nucleotide is 3.3×10^{-5}. The rate of the overall reaction is stimulated by low concentrations of monovalent and divalent cations, and inhibited at higher concentrations. The equilibrium constant of the reaction has been found to be 6.4×10^{-7} molar at pH 6.4 and 28° for the reaction,

Glucose-6-phosphate
+ TPN $\rightleftharpoons$ 6-phosphogluconic acid-δ-lactone
+ TPNH + H^+

II. The in vitro synthesis of hyaluronic acid has been studied in a cell-free system prepared from the Rous sarcoma of chickens.

It has been shown using C^{14}-labeled N-acetylglucosamine-6-phosphate and C^{14}-uridinediphospho-N-acetylglucosamine, that the sugar must be linked to uridine before it can be incorporated into the polysaccharide. The identity of the labeled polysaccharide has been ascertained by digestion of it with testicular hyaluronidase followed by isolation of the corresponding oligosaccharides by paper or column chromatography.

The enzyme system can be fractionated with ammonium sulfate and then will show maximal activity only after addition of hyaluronic acid, presumable as a primer for the reaction. The enzyme system will not add N-acetylglucosamine residues to N-acetylhyalobiuronic acid or to the tetrasaccharide obtained by hyaluronidase digestion of hyaluronic acid. The labeled polysaccharide formed in the usual incubation mixtures appears to be of fairly low molecular weight but is larger than an octasaccharide.

No evidence has so far been found that a disaccharide is an intermediate in hyaluronic acid biosynthesis.

Uridine diphosphoglucuronic acid has not so far been shown to act as a precursor of the uronic acid of the polysaccharide. Extracts of the tumor will however synthesize uridinediphosphoglucuronic acid by enzymatic oxidation of uridinediphosphoglucose.

96 pages. $1.50. Mic 57-48

AN INVESTIGATION OF THE IODINE-ETHYLENE DICHLORIDE REACTION FOR THE DETERMINATION OF VITAMIN D

(Publication No. 18,858)

Marguerite M. T. Lambert, Ph.D.
Purdue University, 1956

Major Professor: F. W. Quackenbush

The transient yellow color (λ_{max} 450 mμ) produced by vitamins D with iodine in ethylene dichloride was reported by Lyness and Quackenbush in 1955, who found that the intensity of the color was greatly enhanced by the presence of a number of agents, particularly mercuric

p-chlorobenzoate. The nature of this reaction, its quantitative aspects, and the enhancing power of a number of other agents were studied in this investigation.

Ethylene dichloride, in a highly purified state, was found to deteriorate on exposure to light or on contact with soft glass. This could be prevented by contact of the solvent with silica gel during storage. The enhancing power of mercuric p-chlorobenzoate is suspected to be due to interaction of the salt with some product of deterioration of the solvent.

Basic compounds were found to enhance the production of the intense yellow color. Weak bases, such as pyridine and N,N-dimethylaniline, were preferable to stronger bases, such as ethanolamine or piperidine, due to production of non-specific absorbance, with a maximum at 365 mμ, by iodine with the stronger bases in the absence of vitamin D.

A pathway for the reaction of vitamin D with iodine is proposed in which iodine is ionized, due to the nature of the solvent and to the presence of base, and I^+ becomes fixed by the terminal methylene group of the vitamin D molecule. Resonance of the carbonium ion so formed could account for production of the yellow color. A secondary blue color (λ_{max} 625 mμ), which developed subsequent to fading of the yellow color, may be due to involvement of the hydroxyl group on C_3 of the sterol nucleus since a similar absorbance maximum is produced in the Liebermann-Burchard reaction with unsaturated sterols, in the Lifschütz reaction with 7-hydroxycholesterol, and in the glycerol dichlorohydrin reaction with vitamin D reported by Sobel, Mayer and Kramer in 1945. The similarity of the glycerol dichlorohydrin reaction to the iodine reaction is also indicated by the production of a violet color (λ_{max} 555 mμ) by vitamin A with both reagents. A non-specific peak at 365 mμ is attributed to I_3^- formed by combination of I^- and free iodine in the reaction mixture.

Measurements of absorbance at 450 mμ can be used for the estimation of from 4 to more than 8 μg. of vitamins D per ml. of reaction volume with a reproducibility to within ± 2%, in terms of vitamin D present, using a 0.4 mM iodine - 0.04 mM pyridine reagent in a 5:1 reagent/sample ratio. The intensity of color produced, per microgram increase in vitamin D present, is of the same order as that produced by the antimony trichloride reaction in the presence of acetyl chloride, and is much greater than that produced by the glycerol dichlorohydrin method as modified by Campbell in 1948.

The effect of changes in concentration of the reagent, and of light and temperature on the reaction were also investigated.

Vitamin A has to be removed prior to estimation of vitamin D due to production of interfering absorbance with maximum at 555 mμ and 365 mμ. Compounds such as ergosterol and its irradiation products may cause interference in the estimation of the lower concentrations of vitamin D, due to the delayed type of reaction occurring for these concentrations, but do not interfere in the more instantaneous type of reaction produced by the higher concentrations of vitamin D in this range.

The reagent is simple to prepare, is stable, and is not affected by moisture. Greater sensitivity or a wider range of applicability can be obtained by changing the concentration of pyridine in the reagent, depending on the needs of the analyst. Lower concentrations of vitamin D can be estimated by the addition of pure vitamin D to the test solution in order to bring the concentration into the appropriate range.

Measurements of absorbance at 365 mμ can also be used as a measure of vitamin D, with an absorptivity of 1500 and a wide range of applicability, but the vitamin D must be isolated from all polyunsaturated compounds or traces of basic compounds. 121 pages. $1.65. Mic 57-49

CHEMISTRY, INORGANIC

A DISPLACEMENT REACTION ON NITROGEN

(Publication No. 19,674)

Husni Rushdi Alul, Ph.D.
University of Michigan, 1956

The N-Methyl-, N-isopropyl-, N-ter-butyl-, and N,N-dimethyl-hydroxylamine-O-sulfonic acids, and N-oxy-piperidine-O-sulfonic acid have been prepared by the action of chlorosulfonic acid on the oxalates, hydrochlorides, or sulfates of the corresponding hydroxylamines. These acids and pyridine-N-oxide-O-sulfonic acid and unsubstituted hydroxylamine-O-sulfonic acid were studied kinetically in their reaction with iodide ion and with aqueous acid.

The reaction with iodide produced iodine and the corresponding amine. The rate was followed spectrophotometrically or by titration with standard thiosulfate. The rate law was overall second order, showing first order dependence on iodide and on sulfonic acid. The reaction is believed to proceed by a slow displacement on nitrogen, followed by a rapid reduction of the resulting iodoamine.

$$I^- + R\text{-}NH\text{-}O\text{-}SO_3H \longrightarrow I\text{-}NH\text{-}R + {}^-O\text{-}SO_3H\,,$$
$$I\text{-}NH\text{-}R + I^- + H^- \longrightarrow I_2 + H_2N\text{-}R$$

The bimolecular rate constant for the reaction of hydroxylamine-O-sulfonic acid with iodide was found to be 0.458 $1.m.^{-1}\,min.^{-1}$ at 1.2°C. For the N-methyl derivative it was much smaller (0.0389 $1.m.^{-1}hr.^{-1}$ at 30°C.), due to the influence of the steric hinderance provided by the methyl group at the site of the reaction. With the other alkylhydroxylamine-O-sulfonic acids acidity was found to promote the reaction, probably through the formation of a protonated derivative of the sulfonic acid, the positive charge of which makes the approach of the iodide ion easier than in the case of alkylhydroxylamine-O-sulfonic acids.

The reaction was aqueous acids produced alkyl-hydroxylaminiom bisulfates.

$$RNH\text{-}OSO_3H + H_3\overset{+}{O} \longrightarrow RNH\text{-}\overset{+}{O}H_2 \cdot HSO_4^-$$

For the unsubstituted hydroxylamine-O-sulfonic acid and its N-methyl derivative, the rate law was again overall second order, showing first order dependence on hydrogen ion and on sulfonic acid. The reaction, however, differed from that with iodide in that introduction of an alkyl group on the nitrogen atom did not affect the rate of the reaction appreciably. For example, at 30°C, the bimolecular rate constants for the hydrolysis of hydroxylamine-O-sulfonic acid and its N-methyl derivative were 0.0835 $1.m.^{-1}hr.^{-1}$ and 0.0677 $1.m.^{-1}\,hr.^{-1}$ respectively.

For the other alkylhydroxylamine-O-sulfonic acids the rate law was complex, showing dependence on acidity greater than order 1. Again, this is probably due to the formation of the protonated derivatives whose rates of hydrolysis are faster than alkylhydroxylamine-O-sulfonic acids. The relative concentrations of the sulfonic acids and their protonated derivatives cannot be estimated from available data, but they would obviously be related to the acid-base characteristics of each compound.

82 pages. $1.50. Mic 57-50

SPECTROPHOTOMETRIC INVESTIGATION OF THE IODINE COMPLEXES OF SOME ORGANIC SULFUR COMPOUNDS

(Publication No. 19,621)

Harry V. Drushel, Ph.D.
University of Pittsburgh, 1956

A rapid spectrophotometric microtitration method was developed for the evaluation of equilibria involved in the formation of molecular complexes. The titration procedure required only two ml. of solution. Titrant was added from an ultramicroburette to the solution contained in a standard 1-cm. quartz cell. Stirring was accomplished by manually operating a small Teflon plunger located inside the cell and the course of the titration was followed spectrophotometrically.

Equilibrium constants, molar absorptivities, and thermodynamic values were determined by this method for the iodine complexes of a number of organic sulfur compounds, pyridine, and some aromatic hydrocarbons. The results of this method were similar to those of the more tedious method of measuring the absorbance of solutions of mixtures of the complex components. Most absorbance measurements were made at the charge-transfer absorption peak of the complex in carbon tetrachloride. Some measurements were made of the shifted visible absorption band of iodine in the complex. A competitive method was also used to study the pyridine-iodine complex.

Since the iodine complexes of most of the sulfur compounds are relatively strong molecular complexes (K_c is between 100 and 200 liters/mole at 25°C.) a novel approach was used to evaluate the equilibria involved. Instead of using an excess of donor as is usually done, an excess of iodine, the electron acceptor, was used. This technique, in addition to providing certain less significant advantages, eliminates the effect of the excess polar donor compound upon the physical environment of the complex and hence also the equilibria involved. Differences between the results in which the donor was in excess and the results in which iodine was in excess were more pronounced when measurements were made at the shifted visible bond of iodine where higher concentrations were required because of the smaller absorptivities encountered.

The sulfur compounds which were studied were arranged in order of increasing base strength as measured by their tendency toward complex formation with iodine. As a consequence of this study, the molar absorptivities of the iodine complexes of the aliphatic sulfides were found to be the same (31 x 10^3 liters/mole cm.) within experimental error. Because of this similarity a basicity scale could also be prepared from "practical" absorptivities calculated from absorbance values of sulfide-iodine blends at a fixed iodine concentration.

Thermodynamic data for the various complexes studied were found to conform to previously observed linear plots of ΔF vs. ΔH as well as ΔS vs. ΔH for iodine complexes of aromatic hydrocarbons and oxygen-containing compounds. The data for the sulfur compounds and pyridine extend these relationships to relatively large negative values of ΔH and confirm the general and fundamental nature of the relationships.

The spectrophotometric microtitration procedure was also used to study the I_2-I_2 interaction in carbon tetrachloride. The ultraviolet spectrum of unassociated iodine and the form of the spectrum of the I_2-I_2 complex were determined. The equilibrium constant and molar absorptivity for the I_2-I_2 complex (which cannot be evaluated directly) have been estimated from ΔH and the general relationships between ΔF and ΔH and between ΔS and ΔH for molecular complex formation with iodine.

Results of this study were discussed in relation to the spectrophotometric method involving complex formation with iodine for the determination of aliphatic sulfides in petroleum. Interferences from the formation of iodine complexes of aromatic hydrocarbons and nitrogen compounds were also discussed. 182 pages. $2.40. Mic 57-51

A STUDY OF THE SELF-EXCHANGE OF YTTRIUM BETWEEN SOLID AND MOLTEN SALTS

(Publication No. 18,329)

John Thomas Looby, Ph.D.
The University of Connecticut, 1956

The original purpose of this investigation was to study the distribution of an ion in trace quantity between a melt and a solid. The original systems $BaCl_2$-$BaTiO_3$ and Ce(III) or Y(III) as the trace ion both resulted in the formation of a second solid phase.

In order to understand better the general phenomenon of exchange, the problem was modified to include the study of the exchange of an ion common to both the solid and molten phases. A high temperature filtration technique was used. The method was to react the solid phase and a molten salt together at a high temperature for a predetermined length of time and then to filter at this temperature. By the use of a radioisotope in the preparation of the solid phase, the amount of exchange could be determined from the activity transferred from the solid to the molten phase.

Very little barium ion exchanged in the system $BaCl_2$-$BaTiO_3$, and even this was masked by the fact that the ratioactive lanthanum daughter of radiobarium went completely into the solid phase.

In the system NaCl-KCl-YCl_3-$YCrO_3$, a limited amount of self-exchange occurred, namely 15%. Attempts to increase this amount by making lattice imperfections failed. The extent of exchange was decreased by preparing the solid $YCrO_3$ at a higher than usual temperature, presumably because the surface area was smaller.

Attempts to effect exchange in the system

$$NaCl\text{-}KCl\text{-}YCl_3\text{-}Y_2O_3$$

led to a reaction forming YOCl. With the use of YOCl as a solid in the system NaCl-KCl-YCl_3-YOCl, 100% exchange was accomplished.

Solubility studies were made to determine the effect of fluoride ion on the solubility of Y_2O_3 and YOCl in molten NaCl-NaF to see if the difference between Y_2O_3 and YOCl with regard to exchange could be resolved. Approximate values for the solubility products of Y_2O_3 and YOCl, and a tentative equilibrium constant for the formation of an yttrium fluoride complex ion as well as the formula of the complex ion were calculated.

Exchange of yttrium in the system

$$NaCl\text{-}NaF\text{-}YF_n\text{-}Y_2O_3$$

was found to be a function of the YF_n^{3-n} concentration and also of the fluoride ion concentration.

The main conclusions drawn from this investigation were:

1) At least a slight solubility of the solid phase is necessary for exchange to occur in these systems.

2) Some exchange will occur at the surface of a solid phase even if the solid phase is completely insoluble.

82 pages. $1.50. Mic 57-52

CHEMICAL AND PHYSICAL STUDIES ON INTERMEDIATE OXIDATION LEVELS OF RHENIUM

(Publication No. 18,628)

Robert James Meyer, Ph.D.
University of Michigan, 1955

While the heptavalent state of rhenium is rather well characterized, relatively little is known of the chemical and physical properties of the intermediate oxidation states of rhenium. In addition, methods for the determination of rhenium which have been developed prior to this study are not completely satisfactory. A satisfactory method for the determination of rhenium would have to be accurate, very sensitive and free from molybdenum interference.

The objectives of the present research problem were: (a) the investigation of the quadrivalent hexachloride complex of rhenium in order to determine the feasibility of developing a spectrophotometric method for rhenium analysis based on the strong ultraviolet absorption of this complex, (b) the improvement of the method of synthesis of the hexahalorhenates (IV), (c) the recording of complete spectra of the solutions of the hexahalorhenates (IV) and the measurement of the solubility of some hexahalorhenate (IV) salts, (d) the characterization of other rhenium compounds.

A sensitive analytical method for the determination of small amounts of rhenium has been developed. An efficient separation of molybdenum and rhenium has been incorporated into the method. The separation is accomplished by extracting the molybdenum from a 2 N sulfuric acid solution with a chloroform solution of acidified cupferron. The measurement is carried out spectrophotometrically after the rhenium has been reduced to the hexachlororhenate (IV) by means of hydrazine in strong hydrochloric acid solution.

A new and less complicated method for the synthesis of potassium hexachlororhenate (IV) and of potassium hexabromorhenate (IV) has been developed. The method involves the use of hypophosphorous acid as a reducing agent. The two salts may be prepared in better than ninety per cent purity without recrystallization and may be obtained more than ninety-nine per cent pure with only one recrystallization.

The spectra of solutions of the hexachloride, hexabromide and hexaiodide of rhenium (IV) have been recorded in both the visible and the ultraviolet regions and the absorbancy indices for all of the major peaks have been calculated. The solubilities of the potassium salts of hexachlororhenate (IV) and hexabromorhenate (IV) and the silver salt of hexachlororhenate (IV) have been measured at 25° C.

An attempt was made to characterize the intermediate complex formed in the hydrolysis of hexachlororhenate (IV) salts. The evidence obtained indicates that a stable intermediate is formed upon addition of three hydroxyl ions to the complex rhenium ion. The evidence also indicates that this intermediate is a cation, rather than an anion as has been previously postulated.

An attempt was made to identify the oxidation state of the rhenium in the rhenium thiocyanate complex anion. No conclusive results were obtained with coulometric measurements or polarographic data. Experiments with rhenium trioxide indicate only that the complex could not be sexivalent or higher. The fact that solutions of potassium hexachlororhenate (IV) are readily converted to the thiocyanate complex seems to indicate that this complex is quadrivalent. 91 pages. $1.50. Mic 57-53

THE ELECTRON ELECTRODE IN LIQUID AMMONIA

(Publication No. 19,786)

John Blair Russell, Ph.D.
Cornell University, 1956

Measurements have been made on a galvanic cell containing an electron electrode and a sodium amalgam electrode in liquid ammonia. From observations at -50° and -70°C the standard E.M.F. of the cell was calculated for these temperatures. Experiments were also performed with a sodium-sodium amalgam cell at the same temperatures. Both cells were found to be thermodynamically reversible.

The results of measurements on these two cells were combined to yield the standard E.M.F. corresponding to the following reaction:

$$Na_{(s)} \longrightarrow Na^+_{(NH_3)} + e^-_{(NH_3)}$$

The results compare favorably with those calculated from data published by Jolly ["Thermodynamic Functions for Species in Liquid Ammonia," U.S. Atomic Energy Commission, UCRL-2201, 23 pp. (1953)].

Studies were also made of a cell containing a sodium electrode and an electron electrode in a saturated solution of sodium in liquid ammonia. In addition, experiments

were run to determine the distribution of sodium between mercury and liquid ammonia.

78 pages. $1.50. Mic 57-54

CHEMISTRY, ORGANIC

SYNTHESIS OF DERIVATIVES OF 3,4-DIHYDRO-3-OXO-1,4,2-BENZOTHIAZINE (PARTS I-III)

(Publication No. 19,504)

E. John Alexander, Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professor: Dr. Fred K. Kirchner

The widespread use of phenothiazine in veterinary practice and the action of some of its derivatives as antihistaminics, substances having an effect on mood and behavior, etc., have made this ring system the center of many investigations. Relatively little, however, has appeared in the literature concerning the possible pharmacologic or chemotherapeutic actions of derivatives of 3,4-dihydro-3-oxo-1,4,2-benzothiazine, compounds that possess some of the structural features of phenothiazine.

The purpose of the present investigation was to prepare new derivatives of 3,4-dihydro-3-oxo-1,4,2-benzothiazine. A search of the literature was made and a brief review of the preparation and reactions of 3,4-dihydro-3-oxo-1,4,2-benzothiazine and some of its derivatives is presented.

Mills and Whitworth in 1927 reported the formation of seven-membered heterocyclic ring compounds, 4-oxo-2,3,4,5-tetrahydro-1,5-benzothiazepine derivatives, when 2-aminobenzenethiol was condensed with simple α,β-unsaturated acids, e.g., acrylic, crotonic and cinnamic acids. These authors also reported that maleic acid reacted with 2-aminobenzenethiol to form 3,4-dihydro-3-oxo-1,4,2-benzothiazine-2-acetic acid. Since this heterocyclic acid was used as a basis for the characterization of many of the compounds prepared during the present study, a successful effort was made to prove its structure.

The present investigation was concerned with the reaction of 2-aminobenzenethiol with β-benzoylacrylic, maleamic and maleanilic acids, as well as with male-monophenylhydrazide derivatives. It was found that these more complex α,β-unsaturated acids condensed with 2-aminobenzenethiol to produce 3,4-dihydro-3-oxo-1,4,2-benzothiazine derivatives that were substituted in the 2-position with phenacyl, carbamylmethyl and acetphenylhydrazide groups, respectively. The structure of these condensation products were substantiated by alternative syntheses.

The intermediate β-benzoylacrylic acid derivatives were prepared from maleic anhydride and the corresponding aromatic compound by well-known Friedel-Crafts procedures. The maleamic and maleanilic acids and the male-monophenylhydrazide derivatives, many of which are new compounds, were synthesized by known methods from maleic anhydride and the corresponding amine, aniline or phenylhydrazine derivative.

Some of the compounds that were prepared during this investigation possessed in vitro antifungal and antibacterial activities. 99 pages. $1.50. Mic 57-55

THE FREE RADICAL PHENYLATION OF ALKYLBENZENES

(Publication No. 19,682)

Harry Saunders Blanchard, Ph.D.
University of Michigan, 1955

Mixtures of alkylbiphenyls are produced by the thermal decomposition of such reagents as benzoyl peroxide and N-nitrosoacetanilide in alkylbenzenes. The mechanism of the process involves formation of phenyl radicals which are the actual substituting species. The purpose of this investigation is to determine quantitatively the isomer compositions produced in the phenylation of a series of alkylbenzenes. Such data are of importance since they provide direct insight into the orienting influence of alkyl groups toward phenyl radicals.

Benzoyl peroxide was decomposed in excess toluene, cumene, t-butylbenzene, o-xylene and phenyltrimethylsilane by heating the solutions at 80-100° until the evolution of carbon dioxide was no longer perceptible. The monoalkylbenzenes were also phenylated by reacting them with N-nitrosoacetanilide and 1-phenyl-3,3-dimethyltriazene. Decompositions involving the former were carried out by dissolving the anilide in excess hydrocarbon at room temperature and controlling the autogenous temperature by external cooling only as necessary. In general, the temperature was allowed to rise from that of the room to 60-80°. When the evolution of nitrogen was no longer perceptible, the mixtures were refluxed for several hours to insure complete reaction. Decompositions involving the triazene were carried out by heating a solution of the triazene in excess hydrocarbon to approximately 100°. At this temperature excess glacial acetic acid was added dropwise to the vigorously stirred mixture. Following the addition, heating was continued until the evolution of nitrogen was no longer perceptible. In all of the phenylations the "biaryl" fraction was isolated by vacuum distillation and purified by standard techniques. The isomer compositions of the final distillates were determined quantitatively by means of infrared absorption spectroscopy.

When toluene, cumene and t-butylbenzene are attacked by phenyl radicals, the ratios of ortho, meta and para substituted biphenyls are the same regardless of whether the radical was generated from benzoyl peroxide, N-nitrosoacetanilide or 1-phenyl-3,3-dimethyltriazene. The per cent para substitution is roughly constant (20); the per cent ortho substitution decreases from toluene (61) to cumene (27) to t-butylbenzene (16); the per cent meta substitution increases from toluene (23) to cumene (53) to t-butylbenzene (62). The strong ortho directing power of the methyl group in toluene is corroborated by the fact that o-xylene gives a higher percentage of 2,3-dimethylbiphenyl (63) than 3,4-dimethylbiphenyl (37). That the decrease in ortho substitution is due, at least in part, to steric hindrance is indicated by the results obtained with phenyltrimethylsilane, which are 31% ortho, 45% meta and 24% para.

The orientation observed on phenylation of toluene, cumene and t-butylbenzene is consistent with the idea that electron delocalization (which favors ortho and para substitution) involving the substituent becomes less important as the alkyl groups become more highly branched. This is tantamount to the statement that the ortho, meta and para positions are becoming more nearly equivalent and,

in the absence of other factors, should give rise to a statistical distribution (40% ortho, 40% meta and 20% para) of isomers in the case of t-butylbenzene. However, because of the steric requirements of the t-butyl group, substitution at the ortho positions is hindered and the radicals are diverted to the meta and para positions. The fact that meta substitution increases rapidly while para substitution changes only slightly may be due to the increased inductive effect as the alkyl groups become more highly branched. Since free atoms and, presumably, free radicals are "electron-seeking" they will attack the points of highest electron density. In the case of t-butylbenzene, the electron density of the meta position is greater than the electron density of the para position by virtue of the coulombic nature of the inductive effect.

The most reasonable mechanism for the phenylation process involves two steps: (1) Formation of a complex between the phenyl radical and the aromatic mucleus being substituted and (2) completion of the reaction by abstraction of the hydrogen atom by a second radical. Such a mechanism is consistent with much of the existing data on the phenylation reactions and is also consistent with the behavior in solution of other free radicals.

159 pages. $2.10. Mic 57-56

THE PREPARATION AND ELECTRONIC PROPERTIES OF A SERIES OF PYRROCOLINES

(Publication No. 17,790)

Richard E. Brown, Ph.D.
University of Maryland, 1956

Supervisor: Professor Francis M. Miller

In the interest of extending the knowledge available concerning the relatively unexplored pyrrocoline ring, an investigation of the electronic properties of this ring system has been undertaken by preparing a series of alkyl pyrrocolines and making a comparative study of their properties with those of the unsubstituted parent base.

During the course of the work, the following new pyrrocolines have been prepared: 1-methylpyrrocoline, 1,3-dimethylpyrrocoline, 2,7-dimethylpyrrocoline, 2-methyl-6-ethylpyrrocoline, 1-methylpyrrocoline-2-carboxylic acid, 3-methylpyrrocoline-2-carboxylic acid, and 1,3-dimethylpyrrocoline-2-carboxylic acid. Compounds previously reported which have been prepared in order to complete the series necessary for the basicity and ultraviolet studies were: pyrrocoline, 2-methylpyrrocoline, 3-methylpyrrocoline, 1,2-dimethylpyrrocoline, 2,3-dimethylpyrrocoline, 2,5-dimethylpyrrocoline, and 1,2,3-trimethylpyrrocoline.

Two new approaches to the preparation of the pyrrocoline ring were investigated, one involving a condensation between succindialdehyde and various substituted pyrroles and the other involving a cyclization of 2-(3-bromopropenyl)pyridine. The former attempt failed due to a rapid linear polymerization of the dialdehyde and pyrrole; the latter attempt failed under the conditions employed due to failure at the allylic bromination step.

A comparative study of the pK_b's of the bases prepared revealed an increase in the basicity of each compound in the series over that of the unsubstituted compound, a result interpretated as indicative of more or less resonance between the nitrogen atom and every position in the ring. The introduction of methyl groups in the 1- or 2-positions increased the basicity in every case, with the effect of the 2-methyl group being the stronger of the two. With the lone exception of a slight increase in basicity of 3-methylpyrrocoline over that of the parent base, the introduction of a 3-methyl group lowered the basicity in every case. The effects on the pK_b's of the various di- and tri-methylpyrrocolines due to the introduction or removal of the methyl groups appear to be partially additive. These results have been interpreted in terms of steric hindrance and the effects which the methyl groups would be expected to have on the relative stabilities of the various contributing resonance structures.

The data obtained from the ultraviolet absorption spectra of the compounds in this series corroborate the pK_b observations. The introduction of methyl groups into the 1- or 2-positions of the pyrrocoline ring tend to shift the entire spectrum about 5 mu. toward the longer wavelengths whereas a 3-methyl group has practically no effect on the absorption spectra of the unsubstituted compound. As noted for the pK_b's, the shifts due to these groups appear to be at least partially additive.

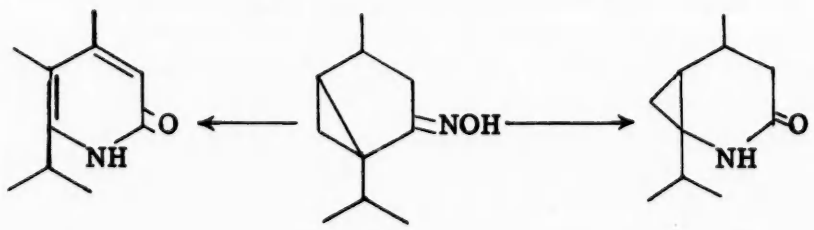
42 pages. $1.50. Mic 57-57

THE BECKMANN REARRANGEMENT OF DIHYDROUMBELLULONE OXIME

(Publication No. 19,915)

William Dickinson Burrows, Ph.D.
Stanford University, 1956

The Beckmann rearrangement of dihydroumbellulone oxime (I) was found to yield a normal product, 5-methyl-1-isopropyl-2-azabicyclo[4.1.0]heptanone-3 (II), rather than the second-order product given by other bicyclic ketoximes with an alpha-quaternary bridgehead. Failure to undergo the second-order rearrangement, which produces unsaturated nitriles, is attributed to the inability of the molecules to attain a planar transition state. In concentrated sulfuric acid, dihydroumbellulone oxime gave 4,5-dimethyl-6-isopropyl-2-pyridone (III).

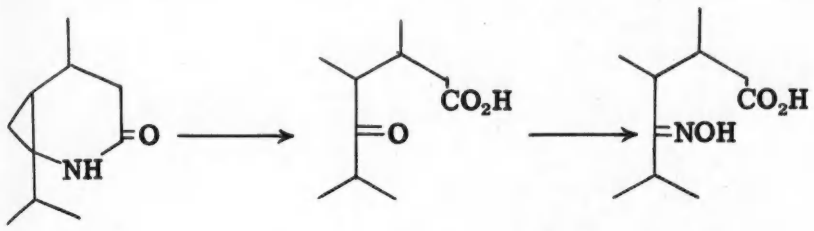


III I II

The toluenesulfonate and bromobenzenesulfonate of the oxime, intermediates in the rearrangements effected by p-toluenesulfonyl chloride and p-bromobenzenesulfonyl chloride respectively, were isolated and characterized.

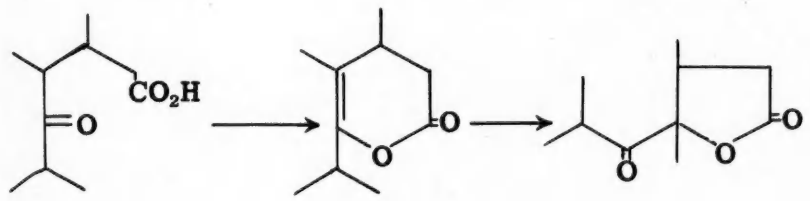
The structure of the rearranged product (II) was proved by either acidic or basic hydrolysis to 5-oxo-3,4,6-trimethylheptanoic acid (IV) and subsequent Beckmann rearrangement of the oxime (V) of this keto acid.

Hydrolysis of the rearranged oxime yielded isopropylamine and isobutyric acid.



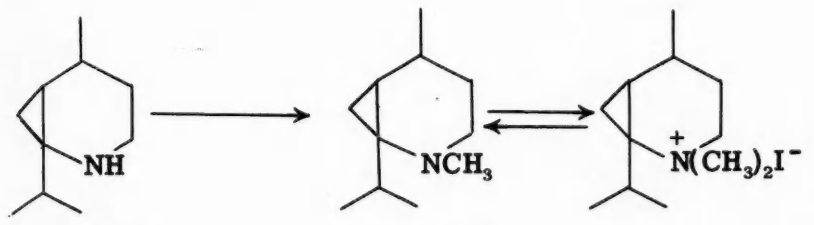
II IV V

When refluxed with acetic anhydride, the keto acid IV gave an enol lactone (VI), which yielded on permanganate oxidation β,γ-dimethyl-γ-isobutyryl-γ-butyrolactone (VII).



IV VI VII

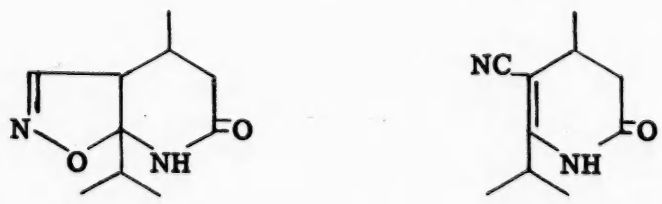
The lactam from the Beckmann rearrangement (II) was reduced by lithium aluminum hydride to 5-methyl-1-isopropyl-2-azabicyclo[4.1.0]heptane (VIII), which was in turn converted to the N-methyl derivative (IX) and the quaternary iodide (X). The quaternary hydroxide of the reduced lactam eliminated methanol rather than undergo β-elimination under the conditions of the Hofmann reaction.



VIII IX X

The N-methyl derivative (IX) did not show the exaltation effects in the ultraviolet reported for vinylamine type compounds, and the ultraviolet spectrum of the lactam II was more like that of ϵ-caprolactam than that of an N-vinylamide.

When treated with nitrogen tetroxide, the lactam (II) gave three products: $C_{10}H_{16}N_2O_2$, $C_{10}H_{14}N_2O$, and $C_{10}H_{15}NO_2$. None of these correspond to the N-nitroso derivative reported to be obtained for a number of N-substituted acetamides. When treated with nitrosyl chloride, the lactam gave $C_{10}H_{14}N_2O_3$ in addition to the same



XI XII

three compounds produced with nitrogen tetroxide. No rigorous structural determination has been made for these compounds, but on the basis of evidence gathered largely from the infrared and ultraviolet spectra, the first two listed have tentatively been assigned the structural formulae 4-methyl-7a-isopropyl-6-oxoisoxazolo[5.4-b]piperidine (XI) and 4-methyl-2-isopropyl-6-oxo-Δ^2-tetrahydropyridine-3-carbonitrile (XII), respectively.

80 pages. $1.50. Mic 57-58

INVESTIGATION OF THE POSSIBILITY OF DETERMINATION OF INORGANIC FLUORIDE AND FLUORINE IN ORGANIC COMPOUNDS BY MEANS OF A HETEROPOLY BLUE SYSTEM (PARTS I-IV)

(Publication No. 18,839)

Robert Patrick Curry, Ph.D.
Purdue University, 1956

Major Professor: M. G. Mellon

Due to the recent increase of interest and importance of fluoroörganic compounds, an investigation of the possibility of applying the molybdosilicic acid heteropoly blue determination of silicon to fluoride and fluorine using the volatility of silicon tetrafluoride was investigated. A nearly specific method for determining fluoride in water based on the following sequence of reactions was developed in this laboratory: The fluoride in a sample is distilled from concentrated sulfuric acid medium as silicon tetrafluoride. The silicon tetrafluoride is hydrolyzed in a borate buffer system and the soluble silicate is determined by formation and subsequent reduction of molybdosilicic acid. The intensity of the color formed is proportional to the amount of fluoride present in the original sample.

For determination of inorganic fluoride in the range 0.1 to 2.0 mg. of fluoride, the above procedure was found to be accurate, sensitive, and free from interference except from borate in the sample. The investigation carried out resulted in development of a method for determination of inorganic fluoride in the range five to forty mg. fluoride using the above sequence of reactions and differential spectrophotometry to increase range and accuracy. The resulting method retains the specificity of the heteropoly method, yields accurate and dependable results, and extends over a range of fluoride concentration which presents difficulty using gravimetric and/or titrimetric methods.

An investigation of the application of a spectrophotometric end point determination to the thorium titration of fluoride using sodium alizarin sulfonate as indicator led to an explanation of the difficulty in perceiving the end point visually in this titration and demonstrates that the usual spectrophotometric end point determination methods are inapplicable in this case. Data supporting the existence of competition for the thorium between fluoride and the indicator was obtained.

A method for the determination of fluorine in fluoroörganic compounds is described which involves combustion of a semimicro sample of the fluorine-containing sample in a moist oxygen stream in the presence of quartz chips and platinum catalyst, hydrolysis of the silicon

tetrafluoride formed from the fluorine during combustion, and determination of the silicon by the heteropoly blue method. The procedure reported can be applied to compounds containing both fluorine and nitrogen. Substances containing fluorine and hydrogen, chlorine, bromine, sulfur, or nitrogen were analyzed by the method and good results were obtained. Only solid samples were used; however, application to liquid or gaseous samples should be possible using conventional manipulation techniques. Adsorption or other means of separation for the removal of various combustion products was found to be unnecessary. For 35 determinations using eleven different pure compounds, a standard deviation of 0.296% was obtained. The fluorine content of the compounds used ranged from 15 to 65%. 181 pages. $2.40. Mic 57-59

A NEW REACTION OF ORTHOESTERS. SYNTHESES OF TRICHLOROHYDROXY SUBSTITUTED ORTHOESTERS AND COMPLEX POLYCHLORO 1,3-DIOXANES.

(Publication No. 18,717)

John Henry Hennes, Ph.D.
Kansas State College, 1956

Propionitrile was prepared in 62 percent yield from ethyl bromide and potassium cyanide by using anhydrous glycerol as the solvent.

Acetyl chloride converted triethyl orthoacetate to ethyl acetate and ethyl chloride, while the same reagent converted triethyl orthopropionate to ethyl propionate, ethyl acetate and ethyl chloride. The yields were almost quantitative. Benzoyl chloride converted triethyl orthoacetate to principally ethyl acetate, ethyl benzoate and ethyl chloride. In this reaction a small amount of dealcoholation occurred to give a three percent yield of the ketene diethylacetal derivative, ethyl 0-benzoyl-benzoyl acetate.

Phenol reacted at 110° with triethyl orthoacetate to form principally ethyl acetate, ethyl alcohol and phenetole.

Chloral and 2,2,3-trichlorobutyraldehyde react with orthoacetates and higher orthoesters without requiring the addition of a catalyst. Three new substituted orthoesters were prepared from triethyl and trimethyl orthoacetate. Chloral reacted with each to form triethyl and trimethyl 3-hydroxy-4,4,4-trichloroorthobutyrate in 81 and 69 percent yields, respectively. Trimethyl orthoacetate reacted with 2,2,3-trichlorobutyraldehyde to give trimethyl 3-hydroxy-4,4,5-trichloroorthocaproate in 68 percent yield.

The orthobutyrates were converted to the corresponding simple esters by heating in acidified alcohol.

The orthopropionate and higher orthoesters add two equivalents of chloral, or of 2,2,3-trichlorobutyraldehyde, and cyclize by elimination of alcohol to form substituted 1,3-dioxanes. By this method there were prepared 1,3-dioxanes having the following substituents and in the following yields:

2,4-bis-(trichloromethyl)-6,6-dimethoxy-(60 percent);
2,4-bis-(trichloromethyl)-5-methyl-6,6-diethoxy-(72 percent);
2,4-bis-(trichloromethyl)-5-methyl-6,6-dimethoxy-(63 percent);
2,4-bis-(1,1,2-trichloropropyl)-5-methyl-6,6-dimethoxy-(29 percent); and
2,4-bis-(trichloromethyl)-5-propyl-6,6-dimethoxy-(50 percent).

Refluxing 2,4-bis-(trichloromethyl)-5-methyl-6,6-diethoxy-1,3-dioxane in acidified ethanol yielded ethyl 2-methyl-3-hydroxy-4,4,4-trichlorobutyrate (90 percent). Heating this 1,3-dioxane in polyphosphoric acid converted it to the corresponding 1,3-dioxan-6-one (65 percent) which was also prepared by condensing ethyl 2-methyl-3-hydroxy-4,4,4-trichlorobutyrate with chloral hydrate (40 percent). Two isomers of the 1,3-dioxan-6-one were isolated as a result of the stated polyphosphoric acid treatment.

Chloral was dehydrohalogenated by aluminum chloride to dichloroketene which was not isolated as such but added hydrogen chloride to form dichloroacetyl chloride (42 percent). 92 pages. $1.50. Mic 57-60

TRICHLOROACETIC ACID ESTERS AS CYCLIZATION REAGENTS: A NEW METHOD FOR THE PREPARATION OF 3-SUBSTITUTED-2-OXAZOLIDONES

(Publication No. 19,510)

George Yohe Lesher, Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professors: J. B. Cloke and A. R. Surrey

It has been found that esters of trichloroacetic acid may be used for the preparation of a variety of heterocyclic derivatives, including 2-oxazolidones, 2-pentoxazolidones (tetrahydro-1,3,2H-oxazin-2-ones), pyrrolidones and cyclic carbonates.

The preparation of a series of 3-substituted-2-oxazolidones and 3-substituted-2-pentoxazolidones from N-substituted-2- and 3-hydroxyalkylamines with methyl or ethyl trichloroacetate is reported. Chloroform is formed during this reaction. With the homologous N-substituted-4-hydroxybutylamines and methyl trichloroacetate the product is an N-substituted pyrrolidine. Here chloroform and carbon dioxide are evolved during the reaction. This new procedure requires no elevated temperatures or catalysts and the products are obtained in good yield. Evidence for a proposed mechanism is presented.

In a related reaction methyl trichloroacetate and 1,2-glycols give rise to cyclic carbonates.

52 pages. $1.50. Mic 57-61

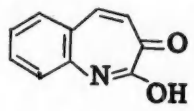
APPROACHES TO BENZAZATROPOLONE

(Publication No. 19,928)

Melvin Look, Ph.D.
Stanford University, 1956

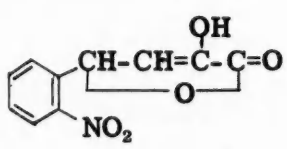
In recent years, the tropolones have been attracting considerable attention because of their unusual properties. Thus the tropolones belong to a group of non-benzenoid compounds obeying the molecular orbital theory used by Hückel to predict aromaticity by rings having $(4n + 2)\pi$-electrons. The tropolones all showed the typical

properties of aromatic compounds. Moreover natural-occurring tropolones, more often than not, show some kind of physiological property. Some are of interest as antibiotics, others as fungicides, and still others as carcinostatic agents. At the time this investigation was started no azatropolones were reported in the literature; therefore attempts were made to synthesize some of them in order to investigate their physical, chemical, and physiological properties. Benzazatropolone (e.g., I), if it existed, is predicted to be aromatic by Hückel's rule; therefore the compound is of theoretical interest. Several approaches to one of the benzazatropolones were explored, and the most promising scheme, at that time, was studied.

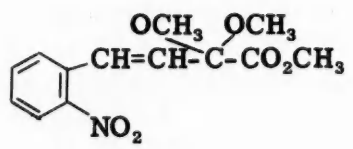


(I)

Baeyer and Drewsen's "o-nitrobenzylidenepyruvic acid" was shown to be in the enol-lactone form (II) previously observable only in several β-bromo substituted benzylidenepyruvic acids recently described by Stecher and Clements. The "acid" formed a methyl enol-ether with diazomethane and an enol-acetate with acetic anhydride. The "acid" did not undergo reactions normally attributed to α-keto-acids. Fischer esterification of the "acid" produced a mixture of products, one of which was the normal keto-ester. Attempts to form an ethylene, a diethyl, or a hemithioethylene ketal of the keto-ester with ethylene glycol or 2-methyl-2-ethyl-1,3-dioxolane, triethyl orthoformate, and mercaptoethanol, respectively, failed under the conditions used. The ester treated with trimethyl orthoformate in boiling acidic methanol or with dimethyl sulfite formed the dimethyl ketal of methyl o-nitrobenzylidenepyruvate (III).

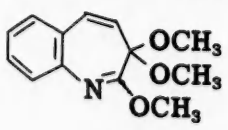


(II)

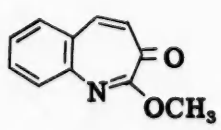


(III)

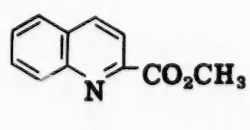
Either catalytic reduction or reduction with hydrazine and Raney nickel of the dimethyl ketal gave 2,2,3-trimethoxy-1-benzazepine (IV). The reduction product was shown to possess this benzazepine structure by spectrum analysis, qualitative tests, quantitative elemental and methoxyl analysis, molecular weight determinations, and correlations with compounds of known structures. Attempts in the conversion of the trimethoxy compound to a benzazatropolone derivative (V) by hydrolysis were unsuccessful. The acid hydrolysis of the trimethoxy derivative opened the seven-membered ring and hydrolyzed the dimethyl ketal group, resulting in ring contraction to form methyl quinaldinate (VI).



(IV)



(V)



(VI)

The rearrangement to methyl quinaldinate suggested that the stabilizing resonance energy theoretically possible in benzazatropolone was not sufficient to modify the unstable nature of an imino-ether bond to acid hydrolysis. The infrared and ultraviolet spectra of the various intermediates are shown and discussed.

Four other approaches to benzazatropolone were also studied. Claisen-type condensations were conducted on methyl o-(carbomethoxy)-succinanilate. A variety of products were isolated. Intermediates were synthesized for the studies related to the cyclization of o-(cyanoacetylamino)-benzyl cyanide and ethyl N-(β-carbethoxyethyl)-phthalamate. Finally, condensations of o-phthalaldehyde with 2-substituted acetamides were studied; a variety of fluorescent products of indefinite nature were isolated.

96 pages. $1.50. Mic 57-62

THE REACTIONS OF VINYLPYRIDINES WITH ACTIVE HYDROGEN COMPOUNDS

(Publication No. 19,637)

George Magnus, Ph.D.
University of Pittsburgh, 1956

A study of the acid and/or base-catalyzed reactions of 2-vinylpyridine, 4-vinylpyridine, and 2-methyl-5-vinylpyridine with ketones, amines, tar bases, nitriles, amides, and esters was undertaken to develop suitable reaction conditions for the pyridylethylation of these active hydrogen compounds. When necessary, the structures of the products obtained were established by the synthesis of authentic samples.

The pyridylethylations of two types of ketones with 4-vinylpyridine have been investigated. These are: (a) ketones which contain only one reactive α-methyl or methylene group or which were symmetrical and (b) ketones which contain both a reactive α-methyl and a reactive α-methylene or methinyl group. Ketones of the first type give monopyridylethylated products of unambiguous structure. Included in this group of ketones are acetophenone, p-methylacetophenone, propiophenone, cyclohexanone, diisopropyl ketone, diethyl ketone, diisobutyl ketone, and acetone.

Ketones of the second type give monopyridylethylated products to which structures were assigned only after chemical proof was obtained. These ketones included phenylacetone, methyl ethyl ketone, and methyl isopropyl ketone.

The following amines have been pyridylethylated successfully with 4-vinylpyridine under acidic conditions: morpholine, pyrrolidine, piperidine, N-ethylaniline, dimethylamine, diethylamine, cyclohexylamine, ammonia, and aniline. It was also found that ammonia can be pyridylethylated with both 2-vinylpyridine and 4-vinylpyridine using hydrochloric or acetic acid as the condensing agent.

Although the pyridylethylation of pyrrole with 4-vinylpyridine fails under acidic conditions, a good yield of product was obtained when sodium metal was used as the condensing agent.

Other active-hydrogen compounds which have also been successfully pyridylethylated with 2- and 4-vinylpyridine, using sodium metal as the catalyst, are: 2-ethylpyridine, 4-ethylpyridine, 2-picoline, 4-picoline,

phenylacetonitrile, acetonitrile, acetamide, propionamide, ethyl-n-butyrate, ethyl isovalerate, and ethyl phenylacetate.

Although quinaldine, lepidine, and isobutyronitrile failed to react with 4-vinylpyridine under basic conditions, fair to good yields of pyridylethylated product were obtained when these compounds were treated with 2-vinylpyridine under basic conditions.

In general, it was found that the direct pyridylethylation of simple, nonactivated esters, such as ethyl acetate, ethyl propionate, ethyl-n-butyrate, and ethyl isovalerate, gave no product or only low yields of products. However, the reaction of the active ester, ethyl phenylacetate, with 2- and 4-vinylpyridine gave good yields of pyridylethylated products.

Since it was found that ethyl γ-(4-pyridyl)-butyrate, ethyl γ-(2-pyridyl)-butyrate, and ethyl α-methyl-γ-(2-pyridyl)-butyrate could not be made by the direct reaction of 4-vinylpyridine with ethyl acetate and 2-vinylpyridine with ethyl acetate and ethyl propionate, respectively, indirect syntheses were used.

Employing the indirect method, these compounds were prepared in good yields by cleaving ethyl α-[β-(4-pyridyl)-ethyl]-acetoacetate, ethyl α-[β-(2-pyridyl)-ethyl]-acetoacetate, and ethyl α-methyl-α-[β-(2-pyridyl)-ethyl]-acetoacetate with ethanolic sodium ethoxide. Other pyridylethylated β-ketoesters which have been cleaved with ethanolic sodium ethoxide are ethyl α-methyl-α-[β-(4-pyridyl)-ethyl]-acetoacetate, ethyl α-ethyl-α-[β-(2-pyridyl)-ethyl]-acetoacetate, and ethyl α-ethyl-α-[β-(4-pyridyl)-ethyl]-acetoacetate.

It has also been found that aniline, N-methylaniline, and morpholine can be condensed in good yields with 2-methyl-5-vinylpyridine using sodium metal as the catalyst. However, cyclohexylamine, piperidine, pyrrole, and di-n-butylamine fail to react with 2-methyl-5-vinylpyridine. 128 pages. $1.70. Mic 57-63

I: CARBANION ADDITIONS IN THE REACTION OF AROMATIC HYDROCARBONS WITH MONOOLEFINS. II: CARBANION AND FREE RADICAL REACTIONS OF SOME SIMPLE OLEFINS.

(Publication No. 19,016)

Victor Mark, Ph.D.
Northwestern University, 1956

Part I

Aromatic hydrocarbons, having at least one hydrogen atom on the α-carbon atom, react with ethylene in the presence of sodium and a compound capable of forming an organosodium compound to give side chain ethylated products.[1]

The object of this study was to determine whether side chain alkylation of arylalkanes with various representative monoolefins other than ethylene can take place in the presence of an organoalkali compound. A further object of this study was to investigate whether a nuclear alkylation can occur under these conditions.

The reaction of toluene, ethylbenzene, isopropylbenzene and diphenylmethane with propylene formed isobutylbenzene, 2-phenyl-3-methylbutane, 2,3-dimethyl-2-phenylbutane and 1,1-diphenyl-2-methylpropane respectively.

The reaction of toluene with isobutylene yielded neopentylbenzene.

In order to emphasize the synthetic utility of this type of reaction, the toluene 1-butene and toluene 1-octene combinations were also included. The reaction product consisted of the expected 2-benzylbutane and 2-benzyloctane respectively.

In the reaction of isopropylbenzene and diphenylmethane with isobutylene the presence of only 2-phenyl-2,4-dimethylpentane and of 1,1-diphenyl-3-methylbutane, respectively, was observed in the final product.

Since it is known that alkylsodium metalates benzene,[2] it was of considerable interest to determine whether nuclear carbanions could add under similar conditions to olefins. For this reason benzene was treated with ethylene, the expected ethylbenzene was isolated and identified. Under similar conditions benzene and isobutylene yielded a mixture of isobutylbenzene and t-butylbenzene; t-butylbenzene and ethylene gave a mixture containing o-, m- and p-t-butylethylbenzenes.

The experimental results, which are interpreted by a carbanion chain mechanism, indicate that the mode of addition of carbanions to unsymmetrical olefins is determined entirely by polar rather than by steric factors. The mode of addition reveals that primary alkyl carbanions are more stable and more easily formed than secondary or tertiary ones. Several aspects of the carbanions and of their reaction mechanisms are discussed.

Part II.

In order to demonstrate the role and importance of the relative stability of the ionic and free radical species in determining the structure of the ultimate product, several simple olefins or olefin pairs were subjected to a reaction in both the presence and the absence of organosodium compounds.

The experimental results confirmed the predictions made on the basis of the relative stabilities of the reacting and of the formed species.

Carbanion reactions:

Starting material	Carbon skeleton of the product
1. propylene	2-methylpentane
2. isobutylene	2,2,4-trimethylpentane
3. cyclohexene and ethylene	ethylcyclohexane
4. cyclohexene and propylene	isopropylcyclohexane (major) n-propylcyclohexane (minor)
5. cyclohexene and isobutylene	isobutylcyclohexane (major) t-butylcyclohexane (minor)
6. cyclohexene	bicyclohexyl

Free radical reactions:

Starting material	Carbon skeleton of the product
1. propylene	n-hexane, 2-methylpentane and methylcyclopentane
2. isobutylene	2,5-dimethylhexane and 1,1,3-trimethylcyclopentane[3]
3. 1-butene	3-methylheptane and 1-methyl-3-ethylcyclopentane

Free radical reactions: (cont.)

Starting material	Carbon skeleton of the product
4. cyclopentene	bicyclopentyl
5. cyclohexene	bicyclohexyl
6. cyclohexene and ethylene	ethylcyclohexane
7. cyclohexene and propylene	n-propylcyclohexane (major) isopropylcyclohexane (minor)
8. cyclohexene and isobutylene	isobutylcyclohexane

The carbon skeleton of these products indicated that, qualitatively and semiquantitatively, the order of carbanion stabilities, I > II > III, accounts for the structure of the products resulting from the reactions carried out in the presence of organosodium compounds, and that the order of stability of free radicals, III > II > I, accounts for the structure of the products resulting from the purely thermal reactions. 196 pages. $2.55. Mic 57-64

1. Pines, Vesely and Ipatieff, J. Am. Chem. Soc. 77, 554 (1955).
2. Schorigin, Ber. 41, 2711 (1908).
3. McKinley, Stevens and Baldwin, J. Am. Chem. Soc. 67, 1455 (1945).

SYNTHESIS OF DIMETHYL δ-METHYLENEAZELATE AND ITS BEHAVIOR IN THE ACYLOIN CONDENSATION

(Publication No. 20,023)

Jerome Panzer, Ph.D.
Cornell University, 1956

Part I. Synthesis of Dimethyl δ-methyleneazelate.-

Two approaches to the synthesis of dimethyl δ-methyleneazelate have been successful. The condensation of methyl acrylate with isobutylene at 210° was by far the better method since it provided in one step a 71% yield of the desired ester. Another approach involved the homologation of 3-methylene-1,5-pentanediol by conventional techniques, which included formation of halides, nitriles, and carboxylic acids. Several other routes were undertaken because they showed more promise than the long homologation, but all were unsuccessful.

Part II. Acyloin Condensation of δ-methyleneazelaic ester.-

Initially the purpose of this research was to synthesize a nine-membered ring with an exo-methylene group and study its stereochemistry. Such a study was of interest because molecular models indicated that, due to interaction among hydrogen atoms attached to non-bonded carbon atoms, there might be enough hindrance to facile interconversion of the different conformations for the ring compound to be resolved into its enantiomorphs. With this view in mind, an attempt was made to prepare the nine-membered ring by the acyloin condensation of the dimethyl δ-methyleneazelate. When this reaction was performed a complex mixture resulted which on distillation through a spinning band column gave several fractions, one of which seemed to be the expected acyloin on the basis of analysis and infrared absorption spectrum. However, a number of reactions which acyloins normally undergo failed to take place. Further evidence, including oxidative and reductive reactions, indicated that the double bond was absent and that a tertiary hydroxyl group was adjacent to a ketone. The only structure consistent with the facts seemed to be bicyclo(4,3,1)decane-1-hydroxy-2-one which may have resulted from reaction between the double bond and one of the free radical centers generated during the condensation. 82 pages. $1.50. Mic 57-65

STUDIES DIRECTED TOWARD A DETERMINATION OF THE ABSOLUTE CONFIGURATION OF OPTICALLY ACTIVE DIPHENYLS

(Publication No. 18,866)

Rolf Paul,[1] Ph.D.
Purdue University, 1956

Major Professors: James H. Brewster

The configuration of 2-tetralin-β-propionic acid has been related to tartaric acid and to glyceraldehyde. The first eight steps toward a synthesis of 1,1′-ditetralyl-2,2′,4,4′-tetramino-7,7′-di-β-propionic acid (IIa) have been carried out. 87 pages. $1.50. Mic 57-66

1. Purdue Research Foundation Fellow, 1954-1955. American Cyanamid Company Fellow, 1955-1956.

THE USE OF BENZYLSULFONYL CHLORIDE IN PEPTIDE SYNTHESES

(Publication No. 17,516)

Chi-Hsieh Peng, Ph.D.
State College of Washington, 1956

Benzylsulfonyl chloride reacts readily with amino acids to yield the corresponding N-benzylsulfonyl derivatives of amino acids. Two procedures were used for the preparation of the derivatives. Procedure A is one in which the amino acid, in alkaline solution, is shaken with pulverized benzylsulfonyl chloride. In procedure B, the reaction is allowed to proceed in water-dioxane solution. N-Benzylsulfonyl derivatives of 23 amino acids were prepared and isolated in excellent crystalline form.

Sodium in liquid ammonia was found to cleave the benzylsulfonyl group from amino acid derivatives in good yield without racemization. When this procedure was used with the benzylsulfonyl derivatives of glycylglycine, L-leucyl-L-leucine, and L-methionyl-L-methionine, the dipeptides were recovered in good yields and without racemization or cleavage of the peptide linkages.

When sodium was added slowly to N-benzylsulfonyl-D,L-methionine in a relatively large amount of liquid

ammonia, D,L-methionine was recovered in a good yield without cleavage of the methyl-sulfur linkage. However, when the sodium was added rapidly, it was necessary to add methyl iodide to the reaction mixture to convert homocysteine to methionine.

Raney nickel was found to be a very effective reagent for cleaving the benzylsulfonyl group from the amino acid derivatives. No racemization was observed when optically active amino acid derivatives were reduced with Raney nickel, nor was the dipeptide linkage in L-leucyl-L-leucine broken under these conditions. When hydrogenations of these acyl derivatives with Raney nickel were carried out at room temperature, excellent yields of the amino acids or the dipeptides were obtained.

Although hydriodic and hydrobromic acids cleave the benzylsulfonyl group from the amino acid derivatives, these reagents were not used extensively in this investigation.

L-Leucyl-L-leucine and L-methionyl-D,L-methionine have been synthesized in good yield using the benzylsulfonyl group to mask the amino group. Over-all yields of 40-43 and 33-40% of the theoretical amounts of L-leucyl-L-leucine and L-methionyl-D,L-methionine, respectively, were obtained. All intermediate benzylsulfonyl derivatives except N-benzylsulfonyl-L-methionyl chloride were obtained readily in crystalline form. Racemization was not observed during either the preparation or the cleavage of these derivatives.

Phenylhydrazides of N-benzylsulfonyl derivatives of glycine, L-leucine, L-methionine, L-phenylalanine, L-lysine, glycylglycine, L-leucyl-L-leucine, and L-methionyl-L-methionine were prepared enzymatically. When N-benzylsulfonyl derivatives of D,L-leucine and D,L-methionine reacted with phenylhydrazine in the presence of papain, the reactions were completely stereospecific for the L-antipodes. The rates of these enzymatic reactions were dependent upon the amino acids which were used; N-benzylsulfonyl-D,L-alanine did not react to yield an insoluble phenylhydrazide in the presence of papain at pH 4.7, derivatives of L- and D,L-leucine reacted slowly, and derivatives of L- and D,L-methionine reacted readily under the same conditions.

N-Benzylsulfonyl-D,L-leucine and N-benzylsulfonyl-D,L-methionine were resolved successfully by reactions with phenylhydrazine in the presence of papain. The phenylhydrazide linkages were cleaved by oxidation with ferric chloride, and the benzylsulfonyl groups were cleaved by hydrogenation separately. Thus the reaction of N-benzylsulfonylamino acids with phenylhydrazine in the presence of papain is useful not only for resolutions of racemic amino acids, but also for enzymatic syntheses of peptides.

Of particular significance in these enzymatic reaction procedures is the fact that N-benzylsulfonyl-L-methionyl-D,L-methionine was resolved successfully into N-benzylsulfonyl-L-methionyl-L-methionine and N-benzylsulfonyl-L-methionyl-D-methionine. This represents a successful resolution of a dipeptide and is a method for synthesizing simultaneously two optically pure dipeptides from the related D,L-amino acid. 67 pages. $1.50. Mic 57-67

ADDITIONS OF CHLOROSILANES TO HALOGEN-CONTAINING OLEFINS (PARTS I-III)

(Publication No. 18,869)

Gerhard W. R. Puerckhauer, Ph.D.
Purdue University, 1956

Major Professors: E. T. McBee and C. W. Roberts

PART I

Trichlorosilane and methyldichlorosilane were added to 3,3,3-trifluoropropene and 2,3,3,4,4,4-hexafluorobutene with various free-radical generating catalysts to give respectively 3,3,3-trifluoropropyltrichlorosilane, 3,3,3-trifluoropropylmethyldichlorosilane, 2,3,3,4,4,4-hexafluorobutyltrichlorosilane, and 2,3,3,4,4,4-hexafluorobutylmethyldichlorosilane. t-Butyl peroxide proved to be the most efficient catalyst of those tried. The methyl, ethyl, and methoxy derivatives of the products were prepared. Trichlorosilane failed to add to perfluoroethylene, perfluoropropene, and perfluoroisobutylene.

PART II

Trichlorosilane and methyldichlorosilane were added to tetrachloroethylene to give trichlorovinyltrichlorosilane, 1,1,2,2-tetrachloroethyltrichlorosilane, trichlorovinylmethyldichlorosilane, and 1,2-bis(methyldichlorosilyl)-1,2-dichloroethene. The methyl, ethyl and methoxy derivatives were prepared; the trimethyl compounds were chlorinated and brominated. Pentachloroethyltrichlorosilane gave trichlorovinyltriethylsilane with ethylmagnesium bromide. Trichlorosilane and methyldichlorosilane were added to the vinyl products to give 1,2-bis(trichlorosilyl)-1,2-dichloroethene, 1,2-bis(trichlorosilyl)-1,1,2-trichloroethene, 1-(trichlorosilyl)-2-(trimethylsilyl)-1,2-dichloroethene, and 1-(methyldichlorosilyl)-2-(trimethylsilyl)-1,2-dichloroethene. All these adducts underwent silicon-carbon cleavage in basic media. Both p-toluenethiol and ethoxide ion added to trichlorovinyltrimethylsilane causing silicon-carbon bond cleavage. Hypotheses for the behavior of these compounds are presented. Abnormalities in the infrared spectra of the adducts are discussed.

PART III

Trichlorosilane and methyldichlorosilane were added with t-butyl peroxide catalyst to 1,1,2-trichloro-3,3,3-trifluoropropene to give trifluorodichloropropenyltrichlorosilane and trifluorodichloropropenylmethyldichlorosilane, respectively. The methyl and ethyl derivatives were prepared. Chlorine added to trifluorodichloropropenyltrichlorosilane to give trifluorotetrachloropropyltrichlorosilane, which was converted to trifluorodichloropropenyltriethylsilane. Trichlorosilane was added to chlorotrifluoroethylene under various conditions to yield chlorotrifluoroethyltrichlorosilane; the methyl and ethyl derivative of this compound were prepared. The properties of known vinylsilanes were compared.

145 pages. $1.95. Mic 57-68

I. THE STEREOCHEMISTRY OF NUCLEOPHILIC ADDITIONS OF THIOLS TO ACETYLENIC HYDROCARBONS. II. ORIENTATION IN THE NITRATION OF ω-STYRYLTRIMETHYLAMMONIUM PICRATE. III. THE BECKMANN REARRANGEMENT OF SOME CYCLIC SULFONE KETOXIMES.

(Publication No. 18,870)

John Alvin Simms, Ph.D.
Purdue University, 1956

Major Professor: William E. Truce

Part I

Although a high degree of stereospecificity has been realized for the addition of hydrogen, halogens and hydrogen halides to acetylenes, similar studies on nucleophilic additions have not been published. Three model systems, utilizing the base-catalyzed addition of thiols to substituted acetylenes, were studied to clarify the stereochemistry of nucleophilic additions to acetylenes.

Refluxing an alcoholic solution of phenylacetylene with sodium p-toluenethiolate resulted in a 79% yield of pure cis-ω-styryl p-tolyl sulfide (none of the trans isomer was isolated), which was readily oxidized to its sulfone. The configuration of this sulfone was substantiated by comparison with the isomeric and known trans-ω-styryl p-tolyl sulfone. Similar results were obtained with sodium methanethiolate and phenylacetylene, the product being methyl cis-ω-styryl sulfide. The corresponding sulfone was different from the known trans isomer. Both methyl -styryl sulfones were reduced to methyl β-phenylethyl sulfone.

With 2-butyne, an alcohol solution of sodium p-toluenethiolate reacted to give a 65% yield of 2-p-tolylmercapto-trans-2-butene. This product has a strong infrared absorption band at 7.70 μ; trans-2-butene and 2-chloro-trans-2-butene have a similar band at 7.80 μ, which is absent in their cis isomers.

A mixture of 1-p-tolymercapto-1-hexene (20%, of undetermined geometry) and 2-p-tolylmercapto-1-hexene (80%) was formed when 1-hexyne was treated with sodium p-toluenethiolate in ethanol solution. Both vinyl sulfides were oxidized to the corresponding sulfones. The vinyl sulfones were catalytically hydrogenated to n-hexyl p-tolyl sulfone and 2-p-tolylsulfonylhexane respectively; comparison of the reduction products with independently prepared n-hexyl p-tolyl sulfone and 2-p-tolylsulfonylhexane established the identity of the adducts.

The stereochemistry of the addition of thiols to phenylacetylene and 2-butyne was shown to be trans. The mixture formed when 1-hexyne was treated with sodium p-toluenethiolate can be explained by considering the destablizing effect of the alkyl group on an adjacent negative charge.

Part II

A number of ω-substituted styrenes (substituents $-NO_2$, $-CO_2H$, $-SO_2^-$, $-\overset{O}{\overset{\|}{C}}-$) have been nitrated and in all instances, ortho-para orientation (with ≅ 2% of the meta isomer) has been observed. It has also been found that these compounds are less reactive than benzene. One explanation for the observed ortho-para orientation is that the transition state is stabilized by interaction with the side chain when attack occurs at the ortho-para positions. It was felt that this explanation could be tested by the nitration of ω-styryltrimethylammonium picrate. Side chain resonance interaction ($p\text{-}NO_2C_6H_4\text{=}CH\text{-}\overset{+}{C}H\overset{+}{N}R_3$) would cause a violation of the adjacent charge rule; hence, such a resonance form should be of diminished importance and should be accompanied by a greater proportion of meta nitration.

ω-Styryltrimethylammonium bromide was prepared in 70% yield by dehydrating β-hydroxy-β-phenylethyltrimethylammonium bromide (a known compound) with hydrobromic acid. It was characterized by reduction to β-phenylethyltrimethylammonium bromide. In addition, its infrared spectrum is consistent with the assigned structure. ω-Styryltrimethylammonium picrate was prepared from the corresponding bromide. It was nitrated in good yield and the composition of the mixture of nitro ω-styryltrimethylammonium picrates determined. The product was oxidized to a mixture of nitrobenzoic acids which was analyzed by known methods. Since only 1.5% of the meta nitrobenzoic acid was found, it appears that the $-CH\text{=}CH\overset{+}{N}(CH_3)_3$ constituent orientates ortho-para to approximately the same degree as other negatively-substituted vinyl groups. Hence, either the adjacent charge rule is not important in determining the relative contribution of transition state resonance forms, or the reason postulated for ortho-para orientation by negatively-substituted vinyl groups is invalid.

Part III

It has been shown that some heterocyclic ketoximes undergo the Beckmann rearrangement to give the expected lactams. However, all of the ketoximes previously examined had the ketoxime function separated from the heterol atom by saturated carbon atoms. It was felt that a conjugated heterol atom might greatly change the ease of the rearrangement.

Three cyclic sulfone ketoximes, thiaxanthone 5,5-dioxide oxime (I), 4-thiachromanone 1,1-dioxide oxime (II), and the un-conjugated keto sulfone, tetrahydro-1,4-thiapyrone 1,1-dioxide oxime (III), were prepared. After 48 hours reflux in phosphorusoxychloride solution with phosphoruspentachloride, oxime I was 70% rearranged to the lactam of 2-(2′-aminobenzenesulfonyl)benzoic acid which was also independently synthesized. Oxime II decomposed under the same conditions but its o-nitrobenzenesulfonate was rearranged by extended heating at 120° with concentrated hydrochloric acid. A 43% yield of the lactam of 2-(2′-aminobenzenesulfonyl)propionic acid was isolated. Oxime III was rearranged rapidly by concentrated sulfuric acid, although oxime II was not affected by this reagent at 100°. Thus, the case of rearrangement in this series is: III >> II ≅ I. 182 pages. $2.40. Mic 57-69

THE ISOMER DISTRIBUTION AND KINETICS OF THE FRIEDEL-CRAFTS BENZOYLATION OF BENZENE AND TOLUENE IN NITROBENZENE SOLUTION

(Publication No. 18,883)

Herbert Lewis Young, Ph.D.
Purdue University, 1956

Major Professor: Herbert C. Brown

The isomer distribution in the Friedel-Crafts acylation of toluene at 25° with benzoyl chloride in the presence of aluminum chloride and with nitrobenzene as solvent was determined. Using infrared spectrometric methods of analysis, the observed isomer distribution was: ortho, 7.2%; meta, 1.1%; para, 91.7%. The presence of the ortho isomer was confirmed by the preparation of its oxime and 2,4-dinitrophenylhydrazone. It was demonstrated that the products of the reaction, 2-, 3-, and 4-methylbenzophenone, do not isomerize under the conditions employed for the benzoylation reaction. It may be concluded that the observed isomer distribution is the result of the relative rates of reaction at the ortho, meta, and para positions. The low amount of ortho substitution (7.2%) suggests that in the benzoylation reaction the substituting species has large steric requirements. The physical constants of pure 2-, 3-, and 4-methylbenzophenone, prepared as infrared standards, are reported.

A limited study was made of the kinetics of the benzoylation of benzene and toluene with benzoyl chloride in the presence of aluminum chloride and with nitrobenzene as solvent in order to establish the relative rate (Toluene/Benzene) of reaction. The kinetics of the benzoylation reaction in nitrobenzene solution are complex and do not follow any simple rate law. Individual benzene experiments follow a third order rate expression, first order with respect to each of the reactants (benzoyl chloride, aluminum chloride, and benzene); thus,

$$\text{Rate} = k_3 (C_6H_5CCCl)(AlCl_3)(C_6H_6) .$$

However, the observed third order rate constant (k_3) decreases with increasing initial concentration of benzoyl chloride and particularly aluminum chloride, being approximately inversely proportional to the one-half power of the initial concentration of the latter component. The third order plots for toluene, first order with respect to each of the reactants, exhibit a slight downward drift. The observed third order rate constants vary in a manner similar to that with benzene. Individual toluene experiments appear to be closer to an overall order of seven-halves, first order with respect to benzoyl chloride and toluene and three-halves order with respect to aluminum chloride. Again, the observed rate constants decrease with an increase in the initial concentration of the reactants.

Since the kinetics of the reaction are complex, the relative rate of toluene to benzene for the benzoylation reaction was determined on an empirical basis, using the inverse ratio of the half-lives under a variety of different initial concentrations (Toluene/Benzene = 149±15). Partial rate factors for the benzoylation reaction were calculated using this relative rate and the above isomer distribution. These data are in excellent agreement with a plot of log pf versus the selectivity factor, $S_f(\log p_f/m_f)$; the substituting reagent in benzoylation is thereby established as a species of low "activity" and high "selectivity."

251 pages. $3.25. Mic 57-70

CHEMISTRY, PHARMACEUTICAL

9-SUBSTITUTED AND 8,9-DISUBSTITUTED 1,3-DIMETHYLISOXANTHINES

(Publication No. 18,647)

Robert Lester Schaaf, Ph.D.
University of Michigan, 1955

This investigation represents a continuation of the study of compounds of the purine type which were prepared in order that they might be tested pharmacologically, especially for diuretic activity. Prior studies had dealt with substituted xanthines; the main purpose of this investigation was the synthesis of isoxanthines.

By treatment of 5,6-diamino-1,3-dimethyluracil with alkyl isothiocyanates, nine 5-(3-alkylthioureido) derivatives (I) were obtained which, in six instances, were successfully cyclized in refluxing hydrochloric acid to 8-thiol-9-alkyl-1,3-dimethylisoxanthines (II). Five of the six 8-thiol compounds were converted into 9-alkyl-1,3-dimethylisoxanthines by treatment with nitrous acid. The general methods employed in the preparation of the above eleven isoxanthines had been reported in literature; four of the compounds were known.

Hitherto it had not been reported that 2-alkylamino-4,6-dimethyl-5,7-diketo-4,5,6,7-tetrahydrothiazolo[5,4-d]-pyrimidines (III), compounds which are isomeric with II, are formed during the conversion of I into II. The examples of compounds of type III which were obtained were previously unknown. The structure of a typical representative, 2-hexahydrobenzylamino-4,6-dimethyl-5,7-diketo-4,5,6,7-tetrahydrothiazolo[5,4-d]pyrimidine, was established by a six-step, unequivocal synthesis from butyl α-nitrosocyanoacetate.

A thermal decomposition product of 5-(3-ethylthioureido)-6-amino-1,3-dimethyluracil was shown to be 8-thiol-theophylline which was identified by its decomposition point, analysis and conversion by Raney nickel into theophylline.

Thirteen 8-alkylthio-1,3,9-trimethylisoxanthines were obtained by alkylation of the known 8-thiol-1,3,9-trimethylisoxanthine with alkyl halides. When benzyl bromide was used as the alkylating agent, 7-benzyl-8-thio-1,3,9-trimethyluric acid was isolated in addition to the desired 8-benzylthio derivative. The 8-methylthio derivative, when refluxed in water with Raney nickel, yielded 1,3,9-trimethylisoxanthine. The 8-β-hydroxyethylthio derivative decomposed into 1,3,9-trimethyluric acid at 250° or when boiled with water; in the former reaction, ethylene sulfide was isolated.

5-Nitroso-6-amino-1,3-dimethyluracil was hydrolyzed with dilute hydrochloric acid to 5-nitroso-6-hydroxy-1,3-dimethyluracil, which was reduced to 5-amino-6-hydroxy-1,3-dimethyluracil with sodium dithionite. The 5-amino compound was treated successively with isopropyl isothiocyanate and hydrochloric acid in an attempt to prepare 8-thiol-9-isopropyl-1,3-dimethylisoxanthine. However, a product of unknown structure was isolated which was found to be identical with an unknown compound obtained from 5-(3-isopropylthioureido)-6-amino-1,3-dimethyluracil and hydrochloric acid. The 5-amino compound yielded 8-thiol-9-butyl-1,3-dimethylisoxanthine when treated successively with butyl isothiocyanate and hydrochloric acid; other products of this type and prepared in this manner had been reported previously.

The effect of hot hydrochloric acid on 5-(3-isopropylthioureido)-6-aminouracil and on o-amino-(3-isopropylthioureido)-benzene was determined. When the thioureidouracil was refluxed with hydrochloric acid, 9-isopropyl-8-thiolisoxanthine precipitated from the reaction mixture. The possibility that the product was the isomeric 2-isopropylamino-5,7-diketo-4,5,6,7-tetrahydrothiazolo-[5,4-d]pyrimidine instead of the thiolisoxanthine was eliminated when the product yielded a sulfur-free compound, undoubtedly 9-isopropylisoxanthine, when treated with nitrous acid. The thioureidobenzene and hydrochloric acid yielded o-phenylenediamine dihydrochloride.

n-Propyl, isopropyl, benzyl and the hitherto unreported hexahydrobenzyl isothiocyanate were prepared from the corresponding amines by successive treatment with carbon disulfide and ethyl chlorocarbonate, essentially according to a procedure previously reported for the preparation of the methyl ester.

7-Butyl-8-bromotheophylline was prepared from 8-bromotheophylline by alkylation with butyl bromide.

The Appendix contains a description of the incidental preparation of four 3,8-disubstituted paraxanthines and the attempted syntheses of 1,3-trimethylene-6-aminouracil and 1,3-trimethylene-6-amino-2-thiouracil.

126 pages. $1.70. Mic 57-71

CHEMISTRY, PHYSICAL

KINETICS OF THE THERMAL DECOMPOSITION OF NITRYL CHLORIDE AT HIGH PRESSURES

(Publication No. 19,917)

George Joseph Casaletto, Ph.D.
Stanford University, 1956

Previous work on the thermal decomposition of nitryl chloride in the gas phase has shown it to be unimolecular reaction taking place according to the following mechanism:

$$NO_2Cl \rightarrow NO_2 + Cl$$
$$NO_2Cl + Cl \rightarrow NO_2 + Cl_2 \ .$$

The reaction has previously been studied in this laboratory under conditions of very low pressures (below 15 mm.), in which case it shows second order behavior; that is, the first order rate constant is directly proportional to total pressure. It has thus been of interest to study this reaction at higher pressures to study the variation with pressure of the first order rate constant. It was also desirable, if possible, to study the reaction at such high pressures (estimated to be well over ten atmospheres) that the first order rate constant becomes independent of total pressure.

The high pressures required to attain the first-order limit have required that apparatus of special design be built, since the reaction has been found to be heterogeneous in ordinary metal reaction cells. The reaction was carried out in a glass cell within a steel pressure vessel, provision having been made to balance the pressure of the reactant mixture inside the glass cell with an equal pressure of inert gas outside to prevent breakage. The apparatus was designed as a steady-state flow system. The reaction was carried out at high pressures, and the gases then expanded to one atmosphere and analyzed optically.

The reaction has been studied at 123 and 147°C. at pressures between 1 and 115 atmospheres. The average energy of activation in this region has been found to be 28 kcal. Although the high pressure limit is not reached at the highest pressures attained, the limiting first order rate constant has been estimated by extrapolation to be 4.68×10^{-3} sec^{-1} at 147°C.

Comparison with theoretical estimates has shown that the rate constant reaches a given fraction of its high pressure limit at pressures considerably higher than predicted theoretically. This has been tentatively interpreted as evidence that an activated reactant molecule is not deactivated at every collision with another reactant molecule.

Further theoretical interpretations have been made in terms of statistical averages over the microscopic rate constants entering into the sum-over-states form of the Lindemann mechanism. 81 pages. $1.50. Mic 57-72

ELECTRICAL PROPERTIES OF SOME AROMATIC FLUORINE COMPOUNDS

(Publication No. 18,888)

Donald Cohen, Ph.D.
Purdue University, 1950

Major Professors: Drs. Thomas DeVries & E. T. McBee

The dielectric constant, dissipation factor and D.C. resistivity of 49 aromatic fluorine compounds have been measured. The dipole moments of these compounds have been calculated using Onsager's equation. A technique of using silica gel in the measuring cell has resulted in removing ionic impurities from the samples and substantially lowers the dissipation factor and increases the resistivity of the compound. Finally, the technique of measuring the dissipation factor before and after the resistivity measurement enables one to determine the purity of the sample with regard to ionic impurities.

61 pages. $1.50. Mic 57-73

ENERGY OF IMMERSION OF GRAPHITE POWDERS WITH DIFFERENT LIQUIDS: FREE SURFACE ENERGY CHANGES ON SOLIDS DETERMINED BY AN ADSORPTION METHOD

(Publication No. 19,687)

Robert George Craig, Ph.D.
University of Michigan, 1955

The purpose of this research was to develop a method for the determination of the free surface energy change during adsorption, or the energy of immersion, of liquids on non-porous powdered solids. The method developed consisted of compressing a free flowing non-porous

powder into a porous plug which had a capillary type system. The porous graphite plugs, although not held under compression during the adsorption process, were found to function essentially as rigid gel type structures. Thus, the determination of the complete adsorption isotherm of an adsorbate on these unsupported porous plugs and the application of the Gibbs' adsorption equation, permitted the calculation of the free surface energy change during adsorption or the energy of immersion, ($\gamma_{SO} - \gamma_{SL}$).

Adsorption and desorption isotherms were determined by means of a modified McBain-Bakr quartz spring balance for toluene, carbon tetrachloride, n-heptane, cyclohexane, n-propyl alcohol and water on various graphite powders and porous plugs at 26° C. The adsorption of organic vapors on graphite powders gave type II isotherms while adsorption of the same organic vapors on porous graphite plugs prepared from these powders gave type IV isotherms. Adsorption of water on porous graphite plugs gave type V isotherms.

Hysteresis was observed in all cases which indicated that free flowing powders function partially as porous solids during adsorption. The difficulties of determining the energy of immersion from adsorption isotherms of non-porous powders are discussed.

The surface area, the apparent density, the particle size, and the size distribution of each of the graphite powders were determined. Also, the surface area, the apparent density, the porosity, the pore volume, the average dry radius and the Kelvin radius range were determined for each of the graphite plugs. The effect of these physical properties on the shape of the resulting adsorption and desorption isotherms was in agreement with the theories of adsorption and capillary condensation.

The values obtained for the energy of immersion for a series of liquids on a variety of graphite plugs were independent of the surface areas and packing pressures and were dependent only on the nature of the surface.

The adsorption data obtained for the adsorption of organic vapors on graphite plugs were plotted according to the simple B.E.T. linear equation and were found to be in agreement with this equation in the range of B.E.T. applicability. The cross sectional areas of the adsorbate molecules were calculated assuming a nitrogen area of 16.2 Å^2. Also, values for the constant "C" in the B.E.T. equation were calculated, which permitted the calculation of the heat of adsorption of the first layer.

The equilibrium functions and the standard free energies of adsorption were calculated for the various systems and the values obtained are discussed.

It is concluded that the only completely satisfactory method for measuring the free surface energy changes during adsorption on finely divided, non-porous solids is to compress such solids into porous plugs which function as porous solids, thus permitting the determination of the energy of immersion from the complete adsorption isotherm of an adsorbate on these porous plugs.

188 pages. $2.45. Mic 57-74

LOW TEMPERATURE PHASE BEHAVIOR AND THERMAL PROPERTIES OF THE SYSTEMS NaF - HF AND NH_4F - HF. LOW TEMPERATURE THERMODYNAMIC FUNCTIONS OF TITANIUM TETRAFLUORIDE.

(Publication No. 19,694)

Robert Donald Euler, Ph.D.
University of Michigan, 1955

The phase behavior in the systems NaF - HF and NH_4F - HF has been investigated to define expected solid-state transitions for certain compounds. Cooling curves have been taken at a sufficient number of compositions to delineate the liquid-solid equilibrium in these systems. Low temperature equilibrium heat capacity measurements have been made in an adiabatic calorimeter on four compositions in the vicinity of ammonium trihydrogen tetrafluoride to confirm the melting characteristics and study the low temperature thermal anomalies.

Results of the phase studies of the NH_4F - HF system indicate the existence of binary compounds, NH_4HF_2, $NH_4H_3F_4$, and $NH_4H_5F_6$, having congruent orthobaric melting points of 126.1 ± 0.1° C., 23.0 ± 0.5° C., and -8.0 ± 0.5°C. The following eutectic temperatures were observed: NH_4F - NH_4HF_2 at 109.0 ± 0.4° C., NH_4HF_2 - $NH_4H_3F_4$ at -6.5 ± 0.9° C., $NH_4H_3F_4$ - $NH_4H_5F_6$ at -14.4 ± 0.3° C., and $NH_4H_5F_6$ - HF at -100.6 ± 0.5° C.

Four incongruently melting binary compounds were found in the NaF - HF system, having the formulae $NaHF_2$, NaH_2F_3, NaH_3F_4, and NaH_4F_5. The following peritectic temperatures were observed: $NaHF_2$ - NaH_2F_3 at 53.8 ± 0.5° C., NaH_2F_3 - NaH_3F_4 at 39.0 ± 1.0° C., and NaH_3F_4 - NaH_4F_5 at 35.5 ± 0.3° C. The NaH_4F_5 - HF eutectic was observed at -94.0 ± 1.2° C. In addition, an invariant temperature was found at -55° C. for compositions from 50 to 75 mole per cent HF. This is tentatively identified as a transformation in NaH_2F_3.

Heat capacity measurements have been made for a composition corresponding to $NH_4H_3F_4$ to study the low temperature thermal characteristics of this substance. Since rather complex behavior was observed, three neighboring compositions have also been investigated. The melting point of the composition $NH_4H_3F_4$ was found to be 295.4° K., corresponding closely to the results of the phase studies. However, extensive premelting occurred, which could not be explained on the basis of impurity. An entropy of fusion of nearly 16 e.u. was found for this composition. In addition a small range of solid solutions was observed in the vicinity of 75 mole per cent HF, so that $NH_4H_3F_4$ can only be considered a compound in the sense of its being the solid solvent for a range of solid solutions. Also a series of unexplained anomalies occur below the melting point. A summary of the temperatures at which anomalies occur for the four compositions follows.

Mole % HF	Temperatures of Thermal Anomalies °K.	Eutectic Temperature °K.
75.05	192,207,232	None
76.08	192,207	254
73.52	192,213	262
74.62	192,231	None

It is likely that these anomalies are related to a disordering of the crystal due to the presence of the ammonium ion,

but further investigation will be necessary to clarify this complex behavior.

In addition, low temperature heat capacity measurements have been made on titanium tetrafluoride from 10° to 300° K., and the standard enthalpies and entropies have been computed by established methods of numerical quadrature. Molal values of the thermodynamic functions at 298.16° K. are:

C_p^0 = 27.31 cal.deg.$^{-1}$, S^0 = 32.195 cal.deg.$^{-1}$, and $H^0 - H_O^0$ = 4891.4 cal.

A comparison of the heat capacity of TiF_4 with other tetrafluorides supports the view that its crystal structure is intermediate between the molecular carbon tetrafluoride or silicon tetrafluoride type and the coordinative zirconium tetrafluoride type.

88 pages. $1.50. Mic 57-75

PREPARATION AND THERMODYNAMICS OF URANIUM OXYHALIDES

(Publication No. 18,605)

Elliott Greenberg, Ph.D.
University of Michigan, 1955

Adiabatic measurements of heat capacity have been made on UO_2Cl_2, $UOCl_2$, and $UOBr_2$ from 5 to 350°K in order to supplement the meager thermodynamic data available for these compounds and also to investigate the possibility of magnetic transitions at low temperatures. No evidence of anomalous behavior was detected in any of the compounds. Values for the enthalpy, entropy and free energy functions are given at rounded temperatures, together with the smoothed heat capacity data. At 298°K, the heat capacity, entropy and enthalpy are 25.78 ± 0.04 cal. deg.$^{-1}$ mole^{-1}, 35.98 ± 0.05 e.u., and 5157.2 ± 7.7 cal./mole for UO_2Cl_2; 22.72 ± 0.03 cal. deg.$^{-1}$ mole^{-1}, 33.06 ± 0.05 e.u., and 4586.3 ± 6.8 cal./mole for $UOCl_2$; 23.42 ± 0.03 cal. deg.$^{-1}$ mole^{-1}, 37.66 ± 0.06 e.u., and 4989.0 ± 7.5 cal./mole for $UOBr_2$. The calorimetrically determined entropy values for $UOCl_2$ and $UOBr_2$ are substantially lower than the previously estimated values.

Detailed laboratory procedures, including diagrams of apparatus employed, have been presented for 200-gram scale preparations of pure, anhydrous UO_2Cl_2, $UOCl_2$, and $UOBr_2$ as well as for UCl_4, U_3O_8, and UO_2 which were prepared as intermediates. Unsuccessful attempts to prepare UOCl are also described.

The results of this investigation, in combination with data from the literature, permit calculation of the entropy, enthalpy and free energy of formation for the substances studied. Equilibrium data in the literature for the disproportionation of $UOCl_2$ and $UOBr_2$ are discussed in relation to a recent determination of the heat of formation of UO_2. A previous claim as to the instability in air of $UOCl_2$ is contradicted by the present studies. Estimates have been made of the equilibrium constants for the two stage reaction of uranium tetrachloride with oxygen.

96 pages. $1.50. Mic 57-76

DETERMINATION OF (d,alpha) REACTION CROSS SECTIONS

(Publication No. 19,697)

Kenneth Lynn Hall, Ph.D.
University of Michigan, 1956

The objectives of this research were to assemble the necessary apparatus and establish procedures for the accurate measurement of (d, α) reaction cross sections, and to apply these techniques to determine several cross sections using the 7.8 Mev deuterons from the University of Michigan cyclotron.

The measurement involved the bombardment of thin targets, subsequent chemical separation of the product nuclei, and determination of the absolute disintegration rate of the β-ray emitting products. To obtain the irradiations a bombardment chamber was designed and installed as an integral part of the cyclotron vacuum system. The deuteron beam was stopped in a Faraday cup, after traversing the target. The beam current was measured by means of a current integrator which was built for this work. A metal evaporator was assembled for use in fabricating thin targets. After bombardment, the targets were dissolved, and the low yield (d, α) reaction products were chemically separated from relatively large amounts of (d, n) and (d, p) radioactive products. This was achieved without the addition of inactive carriers in the case of three of the four elements studied. Absolute counting of the separated products was accomplished by application of the techniques of 4π proportional counting.

The experimental (d, α) reaction cross sections for the formation of the isotopes indicated are:

Na^{22}:	σ = 0.094	± 0.004	barn at 7.8 ± 0.1 Mev
Na^{24}:	σ = 0.151	± 0.006	barn at 7.8 ± 0.1 Mev
P^{32}:	σ = 0.3	± 0.2	barn at 7.7 ± 0.1 Mev
Sc^{46}:	σ = 0.00044	± 0.00033	barn at 7.0 ± 0.8 Mev
1.2-hr Ag^{104}:	σ = 0.0017	± 0.0002	barn at 7.8 ± 0.1 Mev
Ag^{112}:	σ = 0.00049	± 0.00002	barn at 7.8 ± 0.1 Mev
Ag^{111}:	σ = 0.0004	± 0.00004	barn at 7.8 ± 0.1 Mev

The errors quoted are estimated standard deviations. The result for Sc^{46} quoted above is an average of two determinations which differed from one another by a factor of four. The half-life of Na^{24} was evaluated by the method of least squares and found to be 14.93 ± 0.04 hours. Separated isotopes were bombarded to assign the 27-minute and the "1.2-hour" periods in silver to Ag^{104}.

238 pages. $3.10. Mic 57-77

COLLISIONAL ENERGY EXCHANGE IN GASES. USE OF THE SPECTROPHONE FOR STUDYING RELAXATION PROCESSES IN CARBON DIOXIDE.

(Publication No. 19,775)

Marilyn Esther Jacox, Ph.D.
Cornell University, 1956

A survey of the theory of collisonal energy exchange in gases is given, emphasizing recent contributions. The construction of the spectrophone is described in detail.

This instrument is useful for the determination of the relaxation times corresponding to individual infrared absorption bands of gases. After a mathematical characterization as a function of time of the temperature distribution in the measuring cell, the linear relation used to compute the gas relaxation time from the pressure dependence of the phase shift between the exciting radiation and the pressure pulse generated in the gas sample is justified.

Carbon dioxide was chosen for the most intensive study. Measurements were also made on ethane and its mixtures with nitrogen and hydrogen, on mixtures of carbon dioxide with hydrogen and with water vapor, and on nitrous oxide. A low signal to noise ratio, possible variable time delay in the propagation of the sound signal through the cell, and a complex response of the microphone diaphragm as the background pressure is varied appear to present the major difficulties. Conclusive results on the relaxation times of the gases studied would require further specialized study to clarify problems in the sound propagation through the cell and in microphone diaphragm response as a function of pressure, as well as to improve the signal to noise ratio and to decrease the sound contribution of the rotating wheel.

All of the systems reported in this thesis had the same high pressure relaxation time, but there are indications of different relaxation times at lower pressures. Dry carbon dioxide showed a low pressure relaxation time at one atmosphere of 1.2 microseconds for 4.2 micron radiation, of 2.1 microseconds for 2.7 micron radiation, and of 1.4 microseconds for 15 micron radiation. The addition of water vapor did not appreciably change these values, in contrast to previous experiments using ultrasonic techniques. Nitrous oxide showed only one relaxation time, 0.8 microseconds within experimental error. Mixtures of ethane with nitrogen and with hydrogen gave a relaxation time of 0.3 microseconds, 0.0 microseconds within experimental error, while ethane gave a single relaxation time of about 1.4 microseconds. Considerable further study of low pressure measurements is needed. The apparatus gives no indications of relaxation times greater than about 10^{-5} seconds at one atmosphere in any system studied, although the theory predicts much longer relaxation times for the more energetic vibrational modes of carbon dioxide.

Potential applications of the spectrophone include not only further studies of individual relaxation times of polyatomic gases but also investigation of selective deexcitation of vibrational modes on collision with hydrogen, helium, and polyatomic molecules. This study of gas mixtures promises to yield useful information on the directional properties of molecular collisions effective in vibrational deactivation. 216 pages. $2.80. Mic 57-78

DIELECTRIC POLARIZATION OF PROPANE, ISOPENTANE, ETHYL-PHOSPHINE AND CARBON SUBOXIDE, INCLUDING THE INFRARED SPECTRUM OF THE LATTER

(Publication No. 18,616)

John Hart La Rochelle, Ph.D.
University of Michigan, 1956

The experimental part of this study was concerned mainly with the dielectric constants of gaseous propane, n-pentane, isopentane, ethylphosphine and carbon suboxide. They were measured using the heterodyne beat method with a sensitivity of better than 1×10^{-6}, operated at 1 Mc.

Determined was the change ΔC in the capacitance C_s of an evacuated sample condenser due to the introduction of a gas at the temperature T up to various pressures p. In order to correct for the deviations from ideal gas, the values of $\Delta C/p$ were extrapolated to p = 0. The Clausius-Mosotti equation was applied in the form

$$P = \frac{\epsilon - 1}{\epsilon + 2} V = \left(\frac{\Delta C}{p}\right)_{p=0} \times \frac{T}{3C_s} \times \frac{22{,}414 \times 760}{273.16} \text{ cc.}$$

The dielectric polarizations of isopentane and ethylphosphine showed a clear dependence on temperature. For isopentane, measurements at eight temperatures (300-420° K.) fit the equation

$$P = (25.19 \pm 0.01) + (102 \mp 22)/T \text{ cc.}$$

which leads to a permanent dipole moment of 0.13 ± 0.01 D. For ethylphosphine, values at four temperatures (300-332° K.) fit the equation

$$P = (23.66 \pm 0.03) + (8.37 \mp 0.29)10^3/T \text{ cc.}$$

corresponding to the dipole moment $\mu = 1.17 \pm 0.02$ D.

For the other compounds the following molar polarizations and largest possible dipole moments were obtained: propane, $P = 16.07 \pm 0.01$ cc., $\mu < 0.05$ D. (300-420° K.); n-pentane, $P = 25.53 \pm 0.01$ cc., $\mu < 0.05$ D. (300-420° K.); carbon suboxide, $P = 20.26 \pm 0.01$ cc., $\mu < 0.09$ D. (270-304° K.).

The fact that isopentane has a measurable dipole moment, while n-pentane has not, is discussed in terms of the quanticule theory. Possible quanticule formulations of these compounds are presented, which show the differences in charge distribution within the molecules and indicate more clearly the reason for the dipole moment in isopentane than do the usual Lewis structures. The quanticule theory is also applied to a consideration of the fact that the dipole moment of ethylphosphine is larger than that of phosphine (0.55 D.) while that of ethylamine is smaller than that of ammonia. These results, combined with chemical and refractometric evidence, are interpreted to mean that while phosphorus is the negative component in phosphine, it is positive in ethylphosphine.

The absence of a measurable dipole moment in carbon suboxide excludes a non-symmetric structure. In order to decide whether the molecule is linear, the 550, 780 and 1130 $cm.^{-1}$ vibration-rotation absorption bands were measured by Dr. C. W. Peters, using a grating spectrometer at resolutions as low as 0.1 $cm.^{-1}$. No well-defined rotational structure, which would be expected for a linear molecule, was observed. It appears most probable that

carbon suboxide has a plane centro-symmetric zig-zag configuration.

The deviations from ideal gas obtained in dielectric measurements were used for the evaluation of the second virial coefficients, between 300 and 440° K., of propane, n-butane, isobutane, n-pentane and isopentane. The results agree within 10% with values calculated from P-V-T data. From the virial coefficients, the parameters ϵ and of the Lennard-Jones (6-12) potential function were obtained and estimates of the Joule-Thomson and viscosity coefficients were made. 110 pages. $1.50. Mic 57-79

AN X-RAY CRYSTALLOGRAPHIC STUDY OF $K_2Pd(CN)_4 \cdot H_2O$ AND $K_2Pt(CN)_4 \cdot H_2O$

(Publication No. 17,190)

Allen Carrol Larson, Ph.D.
Washington University, 1956

Chairman: Professor Lindsay Helmholz

A study of the monohydrate of $K_2Pd(CN)_4$ was made and two different crystalline modifications of this compound were found. A monoclinic one with a = 15.78Å, b = 16.18Å, c = 18.55Å, $\beta = 107\frac{1}{2}°$, Z = 20 molecules per unit cell and probable space group being $P2_1/c$ or one of lower symmetry, and an orthorhombic one with a = 7.24Å, b = 9.85Å, c = 13.43Å, Z = 4 molecules per unit cell, and space group Pnna. The crystal structure of the orthorhombic form, which is isomorphous with $K_2Pt(CN)_4 \cdot H_2O$, was determined and found to be very similar to that of the series of isomorphous trihydrates studied by Brasseur and de Rassenfosse. The anions are square planar groups and are situated with the entire group lying very nearly in a plane parallel to (100).

The absorption spectra of solutions of $Ni(CN)_4^{--}$ in $K_2Pd(CN)_4 \cdot H_2O$ were studied and were found to be very dependent on the orientation of the plane of polarization relative to the plane of the complex ion.

39 pages. $1.50. Mic 57-80

A STUDY OF ISOTOPIC EXCHANGE BETWEEN POTASSIUM IODIDE AND BENZYL IODIDES. SOLVENT EFFECTS.

(Publication No. 17,684)

Joseph A. Leary, Ph.D.
The University of New Mexico, 1956

The kinetics of the exchange of radioactive iodine-131 between potassium iodide and benzyl iodide has been investigated in acetone and various solvent mixtures. In absolute acetone the reaction was found to be first order with respect to potassium iodide and first order with respect to benzyl iodide. The activation energy and frequency factor were found to be 13,720 cal./mole and 5.7×10^{12} 1./mole/min., respectively.

The kinetics of isotopic exchange between potassium iodide and p-nitrobenzyl iodide was also studied in absolute acetone and in solvent mixtures. This reaction was also found to be bimolecular, i.e., first order with respect to both potassium iodide and p-nitrobenzyl iodide. The activation energy and frequency factor were found to be 14,350 cal./mole and 1.2×10^{14} 1./mole/min., respectively.

The effect of added solvents on the rate of isotopic exchange in acetone at 0.0°C. was also studied. Addition of carbon tetrachloride was found to have no effect on the reaction rate up to a carbon tetrachloride concentration of 1 M. However, addition of the hydroxylic solvents phenol, ethanol, and water inhibited the reaction.

An equilibrium expression for solvation of the iodide ion has been derived by considering the effect of hydrogen bonding between iodide ion and a hydroxylic solvent molecule. From the equilibrium constant, evaluated experimentally, it was possible to predict the reaction rate within experimental error in dilute solutions of hydroxylic solvents in acetone. 138 pages. $1.85. Mic 57-81

ANODIC STRIPPING POLAROGRAPHY

(Publication No. 19,781)

John George Nikelly, Ph.D.
Cornell University, 1956

Anodic stripping polarography was investigated as a method of analysis in which a metal was deposited on an electrode and anodically removed under controlled conditions. Various electrodes were tested for applicability to this method and a mercury microelectrode was found adaptable to the determination of very dilute solutions. Only metals which can be deposited on mercury and anodically removed can be determined with this procedure. The magnitude of the current peaks were proportional to the concentration of the solution. The linear concentration range extends from one to 0.0001 micrograms of metal per milliliter of solution. It was possible to determine lead and cadmium in spectrographically pure zinc. The results were reproducible over long periods of time within a precision of about 3%. No pretreatment of the electrode was necessary, and mixtures of metals in normally unfavorably high ratios were determined satisfactorily. The effects of stirring, voltage scanning rate, deposition time and geometrical aspects of the electrode and cell were studied. A coulometric stripping method was also tested with the mercury electrode.

Except for a silver microelectrode, the other solid electrodes tested showed no advantages. The silver microelectrode offered reproducible results and complete metal recovery after deposition and is consequently adaptable to the determination of very dilute solutions.

74 pages. $1.50. Mic 57-82

FISSION OF THORIUM-232 BY 10-MEV DEUTERONS: MASS-YIELD CURVE

(Publication No. 17,198)

Mangipudi Venkata Ramaniah, Ph.D.
Washington University, 1956

Chairman: Professor Arthur C. Wahl

Fission yields of 16 nuclides have been determined for the fission of Th^{232} by 10-Mev deuterons. The mass-yield curve has the familiar double-humped shape. The highest yield is 5.4 and the lowest in the trough is 0.83%, giving a trough to peak ratio 0.15.

From a comparison of the trough to peak ratio with those for other fission processes, it has been concluded that Pa^{234} is the principal compound nucleus undergoing fission in Th^{232}(d,f) reaction and that the fission contribution of Th^{233}, formed by the Oppenheimer-Phillips reaction, must be very small. The sum of the mass numbers of the complementary fission fragments (those with the same yields) is 230 ± 1, which is consistent with the emission of an average of 4 ± 1 neutrons per fission.

The mass-yield curve for Th^{232}(d,f) has been compared with the mass-yield curves for thermal and 14-Mev neutron fission of U^{235} and for pile neutron and 13.3-Mev. proton fission of Th^{232}. As has been previously observed, the shift of the heavy peak with change in mass of the compound nucleus is found to be small compared to the shift of the light peak.

No fine structure is observed in the mass-yield curve for Th^{232}(d,f). 88 pages. $1.50. Mic 57-83

THE APPLICATION OF CHROMATOGRAPHY ON A STRONGLY BASIC ANION EXCHANGE RESIN TO THE IDENTIFICATION OF AN INFECTIOUS ENTITY WITH CHARACTERISTIC PARTICLES

(Publication No. 19,646)

John Rieden Shainoff, Ph.D.
University of Pittsburgh, 1956

It has been emphasized by M. A. Lauffer that the possession of infectiousness by a preparation which apparently contains a single particle does not warrant the association of that material with the activity. Since the manifestation of the biological activity of a virus requires only trace amounts of active material, the possibility of the etiological agent being an undetected contaminant is a serious one. Lauffer proposed that differential migration methods provide means for an operational approach to the identification of activity with particles. Following a separation procedure, any boundary marking a steep gradient between the physical presence or absence of a particle provides a means of testing the association of the particle with biological activity. Coincidence in the properties of the particle and of the infectious entity provides evidence for identity.

The usual differential migration methods employed in the study of virus characteristic particles, ultracentrifugation and electrophoresis, have been applied to the problem of identification. One other class of differential migration method remains to be studied, chromatography. A form of adsorption chromatography, frontal analysis on a strongly basic anion exchange resin, amberlite XE-67, manufactured by Rohm and Haas Corporation, Philadelphia, was studied in the present investigation. Considerations of the acidic character and the pH stability ranges for a large number of viruses prompted the selection of such a resin as a material which should be widely applicable to the study of virus particles.

In addition to the analytical studies, a chromatographic procedure was developed for the purification of Southern bean mosaic virus. The purification procedure served to remove a pigmented impurity which cannot be removed by precipitation or crystallization of the virus, nor by ultracentrifugation.

The adsorption characteristics of the characteristic particle and the infectious entity of Southern bean mosaic virus were studied as functions of pH at two ionic strengths, 0.08 and 0.04 gm. ions/liter, and at two nucleoprotein concentrations, 1 and 1/2 mg./ml. The dependence of adsorption on concentration and on ionic strength were studied in greater detail at pH 7.24. Measurable adsorption did not occur at pH values below the isoelectric point of the nucleoprotein. At pH values above the isoelectric point, adsorption increased sharply with increasing pH. Adsorption at a particular pH and ionic strength follows a Langmuir type of adsorption isotherm. Adsorption decreases more rapidly with increased ionic strength as the charge on the protein decreases. The adsorption process can be described qualitatively in terms of an equilibrium ion-exchange reaction between the polyvalent protein and simple anions.

Coincidence in the properties of the infectious entity and the characteristic particle of Southern bean mosaic virus was observed under all conditions studied. The identity of the two entities can be demonstrated, within errors of sampling, on the basis of coincidences in a relationship describing the variation of adsorption with pH at a single ionic strength. The errors of the sampling procedure for the infectious entity were of the same relative magnitude as those reported by R. E. Hartman and M. A. Lauffer where electrophoresis was the separation procedure.

The adsorption characteristics of tobacco mosaic virus nucleoprotein were also studied, and differed considerably from those of Southern bean mosaic virus. The differences are explained in terms of the chemical constitutions of the two particles. 66 pages. $1.50. Mic 57-84

A KINETIC STUDY OF VAPOR PHASE CATALYTIC ESTERIFICATION

(Publication No. 19,515)

Paul H. Squires, Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professor: Dr. Chan-Hui Chou

A kinetic study has been made of the esterification reaction between vaporous ethyl alcohol and acetic acid over a granular silica gel catalyst. Data were obtained at temperatures of 200, 240, and 280°C and at total pressures from 1.0 to 6.5 atmospheres.

A differential reactor technique was employed. Aside

from its more usual advantages over the integral-conversion procedure, this technique had several unique advantages in the present application: 1) The effective catalyst activity, which was highly dependent on the water partial pressure, could be maintained essentially constant over the depth of the catalyst bed. This was made possible by the fact that the component pressures, including that of water, did not change appreciably during their passage through the differential reactor. 2) Esterification rates could be studied under conditions of negligible reverse reaction. This was accomplished simply by always including only one of the reaction products at a time in the composite feed to the reactor. Thus, true esterification rates, unclouded by simultaneous hydrolysis rates, were measured. The accuracy of the rate correlation was therefore not dependent on the accuracy of the over-all vapor phase equilibrium constant which, rather surprisingly, is not known to any great degree of certainty.

The reaction rate was found to be linear with the acetic acid monomer pressure and independent of the ethanol pressure above ethanol pressures of 0.2 atmospheres. Ethyl acetate inhibited the esterification rate only slightly.

The influence of water vapor on the reaction rate was studied at partial pressures of water up to three atmospheres. At about one atmosphere water pressure the reaction rate was increased over that in the absence of water by a factor of approximately 1.5 at 280°C to 3 at 200°C, all other component pressures being constant. The rate decreased as the water pressure was increased above about one atmosphere. These observations were interpreted as implying that adsorbed water formed active reaction sites on the catalyst surface, but that at the same time water could be adsorbed on these sites to the exclusion of the reactants. Both of these aspects of the influence of water were taken into account in the derived rate expression.

An esterification rate expression based on a reaction model in which the controlling step was the rate of surface reaction between ethanol and acetic acid which were adsorbed in active form on different catalyst sites satisfactorily represented the kinetic behavior of this system. This reaction rate expression assumed the final form,

$$r/P_{A1} = \frac{A}{(1+K_R P_R+K_S P_S)(1+1/K_B P_B)} + \frac{B(K'_R P_R)(1+K'_R P_R)}{(1+K_R P_R+K_S P_S)(1+1/K_B P_B)} \qquad (1)$$

where r = reaction rate
P (with subscript) = component partial pressure
K (with subscript) = activated adsorption equilibrium constant
K'_R = adsorption equilibrium constant for water on the gross catalyst surface
A,B = temperature dependent constants
Subscripts Al, B, R, and S refer to acetic acid monomer, ethanol, water, and ethyl acetate, respectively.

A linear dependence of the logarithms of the various constants on the reciprocal absolute temperature was found. The rate expression, (1), predicted the data to within ± 6% on the average.

The more usual assumption of competitive activated adsorption of the reactants on the same catalyst sites was not satisfactory unless extreme variations in the energies of activated adsorption with the extent of surface coverage were postulated. 179 pages. $2.35. Mic 57-85

FREE ENERGY OF IMMERSION OF A NON-POROUS SILICA POWDER; FREE SURFACE ENERGY CHANGES OF SILICEOUS SOLIDS AGAINST VAPORS OF DIFFERENT LIQUIDS BY AN ADSORPTION METHOD

(Publication No. 19,725)

John Jay Van Voorhis, Ph.D.
University of Michigan, 1956

The main objective in this investigation was to develop an adsorption method, the data from which, when substituted into the Gibbs adsorption equation, would make possible the evaluation of the free energy of immersion and of other related energetic data for a finely-divided, non-porous solid. Quantitative energetic data of this nature would be useful in the correlation of the wetting characteristics of high-specific-surface-area solids. Prior to this research there had been no satisfactory method for measuring the free energy of immersion of this type of solid.

A non-porous Linde silica powder, No. 2669-95B, was used as the main adsorbent in this study. Plugs of this powder were packed in a specially designed "plug-maker" at two different pressures. During this packing process, high pressures were exerted on the powder by means of a Carver laboratory hydraulic press. The plugs formed from the loose, free-flowing powder were treated as rigid, porous adsorbents. The two types of Linde silica plugs used in this research possessed noticeable differences in apparent densities, porosities, pore volumes, "average" pore radii, and specific surface areas.

Complete adsorption and desorption isotherms were in most cases measured at 26° C. for each type of Linde silica plugs employing as adsorbates the vapor of each of the following eleven liquids: water, methanol, ethanol 1, 1-propanol 1, benzene, toluene, chloroform, carbon tetrachloride, n-heptane, n-hexane, and cyclohexane. The adsorption data were obtained by means of a gravimetric adsorption apparatus employing a modified form of the McBain-Bakr balance.

The gravimetric adsorption data for the Linde silica plugs were integrated graphically by using the Bangham modification of the Gibbs adsorption equation as well as more recent modifications introduced by Fu and Bartell. Reproducible and self-consistent values of the free energy of immersion were obtained for both types of Linde silica plugs. These values are in good agreement with similar data reported in the literature for silica gels. The values of the free energy of immersion at 26° C. for Linde silica plugs range from 139.5 ergs/cm.^{2} with water to 27.7 ergs/cm.^{2} with cyclohexane.

The specific surface areas of the plugs used in the calculation of changes in free surface energy were measured by the conventional B.E.T. method from adsorption data obtained with nitrogen at -195° C.

A comparison was made of the free energy of immersion values at 26° C. determined from adsorption isotherm data of benzene on loose Linde silica powder and of benzene on Linde silica plugs. Since the loose powder functioned during adsorption as a non-porous adsorbent and the plugs as porous adsorbents, it was necessary to

distinguish between these adsorption systems in the evaluation of free surface energy changes by means of the Gibbs adsorption equation. The free energy of immersion value from the adsorption of benzene by the loose powder is 74.5 ergs/cm.^{2} as compared with 49.6 ergs/cm.^{2} for the porous plugs. The results from this comparison serve to indicate that free energy of immersion data reported in the literature for non-porous solids may be questioned. Additional data and discussion are offered to substantiate more thoroughly this viewpoint.

This research discloses that valid free surface energy changes (i.e., free energy of immersion, initial spreading coefficient, and work of adhesion) are obtained for Linde silica by application of the Gibbs equation to adsorption data for the tightly compressed plugs.

The method and principles employed in this research appear, in general, to be suitable for application to other finely-divided, non-porous solids.

333 pages. $4.30. Mic 57-86

ECONOMICS, GENERAL

INDUSTRIAL LOCATION: THE POSSIBILITY OF CANADIAN OWNED FIRMS MOVING INTO NORTHERN NEW YORK STATE

(Publication No. 19,971)

William Frank Eagan, D.S.S.
Syracuse University, 1956

Northern New York State is, and has been, one of the least industrialized parts of the state. It is situated in an economic no-man's-land between the great U. S. manufacturing belt to the south and the Canadian industrial axis to the north. The North Country consisting of Jefferson, St. Lawrence, Franklin and Clinton Counties has a relatively stable population with fewer people in the economically productive years of 25 to 44 than does the state or the nation. In 1949 over 50 percent of the families living in the area had an annual income of less than $3,000 which meant that the demand for consumer goods was considerably lower than in the rest of the state. As a result of these and other factors, the North Country has little to offer new industry as far as skilled labor, markets, raw materials or transportation facilities are concerned.

This paper is a study of the factors that might influence Canadian firms to move into the North Country. The information used was gained primarily from government publications on the state, provincial and national levels, from field trips and interviews and correspondence with individuals who had first hand knowledge of the subject.

The North Country has been considered as a single unit; thus, the figures used have been almost entirely aggregates. Specific firms and individual communities, when mentioned, were used to illustrate situations common to the area.

The conclusions of this study are far from optimistic. The possibilities for a rapid development of manufacturing in the North Country are distinctly limited. Nevertheless, there is a potential for modest increases in manufacturing activity, and, if promotional policy is carefully organized, this may occur within the next decade.

It will be difficult to exploit the industrial potential of this area because of the absence of a coordinated public policy. Unlike the Tennessee and Columbia Valleys, the responsibility for the economic development of the St. Lawrence Valley is divided not only between the United States and Canada but within the United States it is fragmented and further subdivided among a large number of federal, state and local agencies.

Low-cost power will make only a modest contribution to the economic development of the North Country because of the limitations which are inherent in the marketing program of the New York State Power Authority. Most of the firm power is likely to be sold to one or two large electro-process firms which will employ a relatively small number of workers and will attract relatively little by way of ancillary activity.

There are some possibilities for the attraction of Canadian firms to the area. Some of these exist because of the recent growth of Canadian manufacturing industry, with increasing numbers of frmis now able to compete successfully in the American markets. The structure of the U. S. tariff also operates to encourage specific types of Canadian industries to seek U. S. locations. There are some special considerations relating to the proximity of Montreal and Toronto to the North Country that may encourage some Canadian firms to locate branch operations there.

Canadian industries for which a North Country location provides the greatest advantages are: 1) wood-working, particularly plywoods and veneers; 2) leather goods, particularly slippers and moccasins; 3) some miscellaneous metal fabricating firms. 138 pages. $1.85. Mic 57-87

THE NATIONAL DEVELOPMENT PROGRAMS OF THE INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT WITH SPECIAL REFERENCE TO THE ROLES OF GOVERNMENT AND PRIVATE ENTERPRISE

(Publication No. 19,626)

Sonia Steinman Gold, Ph.D.
University of Pittsburgh, 1956

This is a detailed study of the economic development programs which have been prepared for 13 countries by Survey Missions of the International Bank for Reconstruction and Development. Major attention is given to probing for the strategic concepts and basic policies which underlie these concrete proposals for promoting agricultural and industrial development under a wide range of environmental and institutional circumstances. But an even more fundamental objective is to appraise the bearing of these proposals on the relationship between the private and governmental sectors of the economy during the course of development.

After an introductory review of the objectives, scope, and nature of these IBRD development programs, the analysis begins with a consideration of their quantitative aspects. How large are the proposed investment programs in absolute terms, relative to population size and in relation to national income levels? Proposed investment levels are also compared with the actual investment level in recent years in each country. Finally, the programs are compared with one another in respect to the pattern of proposed allocations among the major sectors of the economy.

In order to trace the relationship of guiding principles to detailed recommendations, attention is then concentrated on the two sectors of production, agriculture and industry.

The objectives of agricultural development are found to center around increased self-sufficiency, greater

diversification, and a variety of institutional reforms concerned with tenure conditions, size of farms, and the settlement of new areas. In addition, price policy poses questions concerning the relationship of long-term development objectives to short-term objectives of inflation control and exchange stability. In turn, analysis of the proposed allocation of agricultural expenditures reveals the extent to which such objectives are to be advanced through the development of public irrigation and drainage, improved farming practices, research and experimentation, education and extension services, cooperatives, and credit arrangements.

Before reviewing the nonagricultural sector of development programs, there is a detailed examination of the roles of private and of governmental undertakings in transportation and other public utilities, in mining and in manufactures – along with a summary of Mission evaluations of past performance in government operations. The analysis turns next to the obstacles which have served to restrain private entrepreneurship in industry, including the limited size of markets as well as the absence of needed psychological assurances and material resourses. Finally, consideration is given to the means whereby the IBRD Mission programs hope both to reduce such obstacles to private entrepreneurship and to provide the supplementary developmental impetus of a species of governmental entrepreneurship.

The study concludes that the IBRD development programs represent a serious effort to design a development program which limits the role of government in economic affairs to the minimum consistent with the realization of growth objectives. Even this minimum role represents a significant increase in government participation in the economic process in the 13 countries studied. However, the careful delimitation of the public sector, the reservation of directly productive activity for the private sector, and the recommended aids to private enterprise indicate the extent of the IBRD Missions' efforts to render their development programs consistent with the institutional requirements of a market economy.

The world-wide range of IBRD influence makes its views and recommendations with respect to the role of government in the development process a potent force in the restructuring of national economies. Moreover, the development efforts undertaken on the basis of IBRD strategic guidance represent a rich store of contemporaneous experience which is of major significance to the formulation of a general theory of growth.

370 pages. $4.75. Mic 57-88

SOME ECONOMIC IMPLICATIONS OF RESALE PRICE MAINTENANCE WITH PARTICULAR ATTENTION TO THE DISCOUNT HOUSE

(Publication No. 19,635)

Stewart Munro Lee, Ph.D.
University of Pittsburgh, 1956

This thesis is a study of some of the economic implications of resale price maintenance, popularly known as fair trade. This is not a study of the many arguments, pro and con, with regard to resale price maintenance, per se. The main area of study centers around resale price maintenance, the problems involved in its enforcement, and the relationship which exists between resale price maintenance and the growth of the discount house. Attention is directed towards resale price maintenance and economic theory, notably its influence upon certain economic institutions and its impact on the consumer.

Personal interviews and correspondence with representatives of trade associations, trade publications, retail stores, and manufacturing firms provided much of the information incorporated into this study.

By tracing both the state and Federal legislative history of resale price maintenance and in depicting the growth of the discount house movement, it is shown that a parallelism exists. The impact of both Federal and state legislation and of the discount house movement on the marketing structure within the United States has been such as to bring about changes in the patterns of distribution.

The passage of a fair trade law in California in 1931 stimulated similar action in many other states. The action of the states culminated in the passage of a Federal fair trade act. The passage of state and Federal fair trade laws has not brought about an effective program of resale price maintenance in the marketing sector of the economy. The effective enforcement of fair trade laws seems at times to be impossible in many areas and fields. This has been particularly true with the growth of the discount house movement. The most recent impetus to the discount house growth was the passage of the McGuire Act in 1952.

The evidence presented in this study indicates that the discount houses and the resale price maintenance laws have developed over the same period of time, that discount houses have sold and are selling fair trade articles at discount prices in large volume, that the restraining of "legitimate" dealers from making price concessions on fair trade products has forced some business into the discount houses, and that available data prove that it is just as fallacious to draw the conclusion that the discount house was created solely due to resale price maintenance laws as it is to conclude that there is no relationship existing between the growth of discount houses and the passage of resale price maintenance laws. The relationship exists, but available data do not make possible the measurement of the degree of relationship which does exist.

The discount house has made its niche in American retailing and will not be dislodged easily. It has influenced, is influencing, and will continue to influence the retailing function of marketing. The heart of out national economic policy long has been faith in the value of competition, and we are seeing the effects of this competition in the emergence of the discount house.

It has been assumed in this study that this country is committed to a system of predominantly free enterprise. Evidence seems to indicate that resale price maintenance laws and an effectively competitive system are incompatible. The findings of this study indicate that the repeal of these resale price maintenance laws will be beneficial to the national economy. 282 pages. $3.65. Mic 57-89

THE IMPACT OF FOREIGN DIRECT INVESTMENT ON AN UNDERDEVELOPED ECONOMY: THE VENEZUELAN CASE

(Publication No. 20,021)

John Robert Moore, Ph.D.
Cornell University, 1956

Many hypotheses have been set forth concerning the impact of foreign investment on underdeveloped areas. Some cast foreign investment as a "hero"; others place it in the role of "villain". This study presents a systematic theoretical analysis of the alternative types of impact that could be expected from direct foreign investment, and proceeds to an historical and institutional examination of Venezuelan experience with foreign direct investment in petroleum.

The study examines with most particularity the hypothesis of United Nations economist Hans Singer that foreign direct investment has impeded or at least made little contribution to the economic development of backward areas. A theoretical discussion elaborates on the Singer hypothesis and spells out the possible channels of effect of direct foreign investment in some detail. These are:

1. Primary Effects.
   a. Factor proportions and factor prices.
   b. Multiplier effects.
   c. Foreign exchange rate effects and the terms of trade.
   d. Gains from trade as affected by the terms of trade.
2. Other Effects.
   a. Growing points.
   b. Social capital.
   c. Product availability.

The discussion argues that the impact on factor proportions and incomes will depend on the circumstances surrounding international and intranational mobility of the factors. It may often be necessary to introduce the theory of non-competing groups. With regard to multiplier effects it is argued that a special "partial" multiplier formula is required to analyze the peculiar nature of the impact of export-oriented direct investment. Through analysis of the multiplier and multiplicand various policies which may be of benefit to developing countries can be ascertained. It can be observed, for example, that a rejection of the doctrine of comparative advantage in the interest of diversification may be desirable to the extent that multiplier effects are strengthened.

Analysis of the terms of trade effects is seen to be complex and to involve conflicting tendencies. A favorable change in the terms of trade consequent upon a persistently favorable balance of trade (such as frequently results from direct investment), may so affect the relative price structure as to stifle development in the domestic sector. For this and other reasons, it is argued that neither the commodity terms of trade nor any other simple index can be regarded as an adequate measure of total gains from trade when such gains are an aspect of the development process. The "Other Effects" are developed briefly.

In application of the theoretical model to Venezuela three distinct periods are recognized:

Period I (1900-1930): Foreign exploitation had virtually no effect on the domestic economy.

Period II (1930-1947): Unfavorable developments, particularly with regard to the terms of trade effects, assumed great importance and threatened to blot out any favorable multiplier effects.

Period III (1947-date): Favorable effects seem to have been pushing unfavorable effects aside.

From this it concluded that the Singer hypothesis may be valid in certain circumstances and not valid in others. The most important determining factor would seem to be the policy decisions of the investing concerns and the receiving country.

The stage is thus set for a discussion in the final chapter of policies that might increase the beneficial effects to Venezuela. Among the policies discussed are those concerned with (a) concessions to foreign firms for extracting resources, and (b) foreign exchange rate management.

In a lengthy conceptual and statistical appendix an attempt is made to establish a series of national income sector accounts appropriate to the structure of the Venezuelan economy for 1936, 1949, 1950, and 1951. Estimates are also made of saving and investment from 1940 to 1951. The data are employed in discussing the pattern of development in Periods II and III. 322 pages. $4.15. Mic 57-90

ECONOMICS OF THE PRICING OF URBAN BUS TRANSPORTATION

(Publication No. 19,548)

Roger Carleton Van Tassel, Ph.D.
Brown University, 1956

This thesis is a study of the problems involved in pricing urban bus transportation. The objective of the study is to establish criteria and to develop information relevant for an evaluation of alternative pricing systems.

Traditionally, urban bus transit has been treated as a regulated public utility. In recent years, the increases in operating costs and the decline in the number of passengers carried have made it increasingly difficult for operators to cover costs. Transit service furnished has been curtailed; and, in some locations, abandoned. The continuing loss of riders presents a major problem to the operators, to persons still relying on bus service, and to the municipalities that must deal with the traffic problem generated, in part, by persons shifting to private cars. Some of the factors contributing to these problems are perhaps beyond the control of the industry; however, it is hoped that an examination of the present pricing system in the industry will point to changes that will help slow the decline in riding and otherwise contribute to the continued solvency of the industry.

In evaluating a pricing policy for transit, the primary emphasis is placed on the relevant economic factors.

While economic factors alone may not provide a sufficient basis for public regulation, the economic effects of alternative pricing systems need be considered.

There are difficulties in satisfying the criteria for an optimum pricing system. Two important criteria that price should be equal to marginal cost and total revenue should cover total cost may be hard to satisfy simultaneously with marginal cost lying below average cost for much of transit service produced.

In addition, there must be determination of a significant unit of output if marginal cost is to provide a useful guide in pricing. The individual bus passenger is too small a unit to be of significance in affecting the costs of furnishing service. Therefore, the marginal and average costs of service are calculated according to vehicle hours or vehicle miles. The cost of the service furnished is then averaged and allocated to the individual passengers carried.

From data made available by several bus companies, it is possible to demonstrate that the marginal cost of furnishing service varies with the hour of the day and the length of the trip. Peak-hour service is the most costly to furnish, partly because of higher variable costs in operating at slower speeds and partly because a relatively larger capital cost is allocable to peak service. Figures from the United Transit Company of Providence, Rhode Island, show, for example, that the marginal cost per vehicle mile is nearly three times as great at the peak hour than at off-peak hours.

In addition, the evidence indicates that the demand is inelastic for transit riding as a whole, but with a considerable variation in the degree of elasticity for different types of service. Demand is most elastic for midday and short-haul riding and is least elastic for peak-hour and late evening service.

In consideration of these factors, it does not seem that a continuation of the present flat fare system is in the best interests of the public, or the transit operators. A fare system is recommended whereby the fare charge would vary with the hour of day and length of trip. The possible gains in economic efficiency from such a fare system should make it worthwhile to attempt to overcome any political and administrative difficulties.

238 pages. $4.35. Mic 57-91

ECONOMICS, FINANCE

GOVERNMENTAL ACCOUNTS FOR ECONOMIC PLANNING IN BURMA

(Publication No. 19,693)

Robert Firestone Emery, Ph.D.
University of Michigan, 1956

In low income countries conventional government budgets and other familiar types of economic data are deficient in certain respects in serving as useful guides for economic planning. The purpose of this study, therefore, is to recast the data provided in certain government financial statements into accounts which are economically meaningful, chiefly from the viewpoint of resource planning. The governmental accounts of the Union of Burma are used to illustrate in detail the structure and principles underlying the proposed set of accounts.

It is important from the viewpoint of resource planning to know for each budget year the government's contribution to its net worth position since there is a relation between changes in the government's net worth and national productivity. In order to measure this contribution the economic classifications in the proposed set of accounts employ the divided budget principle, government transactions being divided into either current or capital transactions. When all transactions are properly recorded according to the principles underlying the proposed divided budget, the balance on current account will indicate the contribution to government net worth. Capital transactions, both real and financial, will reflect changes in the size and composition of the government's net worth.

Using actual figures for 1950-51, accounts employing certain economic categories are constructed for the central government sector and the public undertaking sector, a continuity being maintained in the accounts for each sector. These two sectors are then grouped into two combined accounts, one indicating the nature and volume of the capital formation for both sectors, the other the changes in financial assets and liabilities for both sectors.

As an additional aid to economic analysis and resource planning, the principles underlying a domestic cash consolidated budget are explained and an illustrative cash budget for the central government sector for 1950-51 is constructed. Central government expenditures for 1950-51 are reclassified according to a limited number of major functions for the purpose of illustrating the principles underlying a functional rather than an economic classification of government operations.

While the proposed set of accounts are designed to include eventually all government sectors, it is necessary due to insufficient data to restrict the illustrative accounts to the central government sector and the public undertaking sector. With this reservation, however, the result of the study is a set of accounts which illustrates with actual data the structure and principles underlying an economically meaningful reclassification of government accounts.

296 pages. $3.80. Mic 57-92

THE TAXATION OF PROPERTY IN KANSAS, 1855-1955

(Publication No. 18,278)

Lawrence Albert Leonard, Ph.D.
Cornell University, 1956

With few exceptions the Kansas law in regard to the taxation of property remained static during the century following the adoption of the first Kansas territorial constitution in 1855. The most important aspect of the organization for local assessment has been the diffusion of the assessing power among some three thousand poorly paid, untrained, uncoordinated, and politically chosen deputy assessors.

The first State Tax Commission (1907) and its successors, including the present State Commission of Revenue and Taxation, has had the legal power and duty to supervise

the local assessors with the objective of attaining approximate equality of assessment. They have, however, with rare exceptions, been unable or unwilling to exercise this power.

As the result of this inadequate administrative machinery, and because of the secular tendency of economic properties to become increasingly numerous and complex, the assessment performance has never been good. Six studies (1897-1954) of assessment to sales ratios of real estate have all revealed almost unbelievable inequalities of assessment among local assessing units, the major classes of property both state and locally assessed, and individual properties within any given assessing unit. The assessment of real estate and most classes of personalty has been definitely regressive. Reliable information on the actual market values of state assessed properties, especially railroads and intercounty utilities, is difficult to obtain. This is in part a result of the lack of a professional, nonpolitical state assessment organization and in part because the so-called "market value" of a property which never sells as a unit must always be a rather nebulous conception.

The local and state boards of review and equalization have acted as "safety valves" to relieve those few property owners who have felt sufficiently aggrieved to press for reduced assessments. Equalization by classes of property has been infrequent, and, when made, usually arbitrary.

Periodically, attempts have been made to reform the law and administration. The most important suggested reforms have included the increase in the size of the local assessing unit (only nominally attained in 1955), the nonpolitical selection of professional assessment officials, the inauguration of an effective state supervision of assessment, and the placing of assessment on a more scientific and objective basis. The factors responsible for the repeated rejection or crippling of reform programs are complex, including the strong tradition of local home rule, the general public apathy toward such matters, and the active opposition of persons with vested interests in the status quo.

The increasing trend of state and local expenditures, as well as the vague public realization that the ownership of property had become less and less a criterion of either ability-to-pay or benefits received, led to the adoption of important new state taxes in the 1920's and 1930's and the inauguration of state aid and grants to local governments. This resulted in the sharply diminished importance of property taxes in relation to total local and particularly to total state revenues. Nevertheless, in 1954 the revenue from state and local property taxes still exceeded those from all state taxes.

To rectify the inequalities of the property tax and to bring about future adjustments of the Kansas tax system to changing economic and social conditions, the writer suggests a broad reform program which includes the adoption of operational definitions of value for most classes of property and, for those properties for which realistic definitions are not possible, the abandonment of property taxation in lieu of special taxes based on a more objective criterion, such as gross operating revenue. The necessary requisite for the success of such a long-range program would be continued and intensive research and public education.

368 pages. $4.70. Mic 57-93

ECONOMICS, HISTORY

THE PREMIUM GOLD CONTROVERSY IN THE INTERNATIONAL MONETARY FUND

(Publication No. 19,240)

Theodore Geiger, Ph.D.
Columbia University, 1956

This is an analysis of a controversy between an international organization, the International Monetary Fund, and one of its members, the Union of South Africa. The immediate issue was whether South Africa should export part of its newly mined gold at prices in excess of $35 an ounce, which had been fixed by the Fund as the official price for all international gold transactions among its members. The question of premium gold sales was important in itself. But, because the controversy also generated disagreements over much more fundamental problems of international monetary policy, the real issue soon came to be the Fund's gold policy as a whole, and not merely its specific objection to premium gold transactions. The period covered in detail in this study is from August, 1948 to May, 1950. The history of the controversy is examined both from the perspective of the substantive economic issues involved and from that of the nature of the decision-making process in, and the administrative problems of, an international organization.

The origins of the premium gold controversy are to be found in the demonetization of gold during the interwar years and in the revival of the ancient practice of private gold hoarding in consequence of the economic and political insecurity of the World War II and postwar periods. Private individuals, particularly in soft currency countries, were willing to pay premium prices for gold which they obtained by leakages from government gold reserves, by illegal diversion of gold sold for industrial, artistic and medical purposes, and from existing private hoards. Owing to postwar economic difficulties, South Africa wished to increase its earnings from gold exports and to enhance the profitability of its gold mining industry by obtaining a higher price for its newly-mined gold than $35 per ounce. While South Africa maintained that its gold sold at higher prices would be used abroad only for permitted industrial, artistic and medical purposes, the Fund was convinced that most, if not all, of this gold would become a new source of supply for the premium market and would soon disappear into private hoards.

In June, 1947, the Fund adopted a policy of enlisting the active cooperation of its members in suppressing premium sales and discouraging private hoarding because of their detrimental effects on the Fund's efforts to stabilize national currencies. When South Africa began to sell gold at premium prices, a majority of the voting power in the Fund's Executive Board, led by the American and British representatives, took the view that such sales would violate the spirit, if not the letter, of the June 1947 policy statement. Another group of Executive Directors, chiefly from the continental West European countries, were also opposed to premium gold sales but differed with the majority over the best method of discouraging them. The majority favored more comprehensive and rigidly enforced direct controls; the minority believed that premium gold sales would disappear only when greater

freedom was permitted in international commercial and financial transactions. Despite their disagreement, both groups -- as well as the Staff of the Fund -- were concerned to avoid an open break with South Africa but were equally desirous of inducing it to abandon its premium sales. For its part, the South African Government was determined to continue its profitable premium sales while at the same time remaining a member in good standing of the Fund. The resulting impasse was only broken by the skillful mediation of Camille Gutt, the Fund's Managing Director, and by the eventual disappearance of the economic conditions which made premium gold sales possible and profitable. 220 pages. $2.85. Mic 57-94

UNITED STATES INTERNATIONAL RAW MATERIALS POLICY AND CONTROLS DURING AND SINCE THE END OF THE KOREAN EMERGENCY

(Publication No. 19,708)

Herbert Hugo Liebhafsky, Ph.D.
University of Michigan, 1956

In The Wealth of Nations Adam Smith justified restrictions on international trade on grounds that defense was more important than opulence.. Today international economic and political relationships have become more complex than when Adam Smith wrote, and defense and opulence cannot be so simply contrasted. Present day complexities are peculiarly apparent in trade in raw materials.

The purpose of the study is to evaluate United States experience in raw materials matters in recent years and to point out the interrelationships and the consistencies and inconsistencies of various strands of current raw materials policy and policy recommendations. The Korean emergency experience provides an especially useful basis for such an evaluation.

In Part I of the study the status and substantive nature of the United States long-term policy of wide international trade as these stood at the beginning of the Korean emergency are determined from international agreements, statutes, and United States Government and United Nations publications. Particular attention is given to the General Agreement on Tariffs and Trade, which also applies to trade in raw materials.

In Part II data are examined for raw materials prices and quantities, United States stockpile appropriations and purchases, and export licensing to determine the nature of the impact of the Korean emergency on raw materials markets. A finding is made that the apparent United States policy early during the emergency was one of "exporting as little as possible" and "importing as much as possible." This policy was inconsistent with the political policy of collective defense and contributed to economic difficulties in other allied countries. In May 1951 the United States adopted an international allocation policy of "equitable distribution of burdens and sacrifices" to maintain the collective defense system intact. United States experience in the International Materials Conference is described and evaluated to determine the feasibility of international implementation of the policy, which was also applied unilaterally.

In Part III current international raw materials policy is evaluated in the light of recommendations in the Bell Report and by the Paley and Randall Commissions, and on the basis of the Korean emergency experience.

The study results in a number of conclusions. (1) National security exceptions to a policy of wide multilateral trade, such as Adam Smith approved, rest on an assumption that a nation is not participating in a collective defense system; a policy of wide international trade within the collective defense system is the economic policy which must logically accompany a political policy of collective defense. (2) The International Materials Conference was a successful method of implementing the policy of equitable distribution, and was neither a cartel nor an unlawful attempt by the executive branch of the government to apply Chapter VI of the Havana Charter. (3) One aspect of current stockpile policy, the national security exception in the Trade Agreements Extension Act of 1955, and the Domestic Minerals Program Extension Act of 1953 are all three inconsistent with a policy of wide multilateral trade and constitute qualifications of the current policy of collective defense. (4) Market instability during the Korean emergency period provided a frame of reference within which underdeveloped countries placed increased emphasis in the United Nations on commodity agreements and on increased economic development assistance from industrialized countries. Concessions have recently been secured by underdeveloped countries in regard to these matters in the United Nations and in the revised General Agreement on Tariffs and Trade. (5) The history of these concessions suggests that a policy of increased investment in raw materials alone by the United States would be unsuccessful, but that such a policy accompanied by increased economic development assistance might be fruitful.

642 pages. $8.15. Mic 57-95

IRAN'S FOREIGN TRADE POLICY AND ECONOMIC DEVELOPMENT IN THE INTERWAR PERIOD

(Publication No. 19,930)

Gholam Reza Moghadam, Ph.D.
Stanford University, 1956

This study attempts to analyze and evaluate the system of quantitative trade and exchange controls adopted in Iran during the interwar period, with a view to determining the impact of these policies on the country's economic development. The impetus to the adoption of these controls came from the depression abroad, from monetary instability at home, and from a balance of payments problem caused by Iran's efforts to step up the rate of investment from internal sources.

It is shown that although the government made a good start in introducing modern industry to Iran, the restrictive policies adopted in the foreign trade sector acted increasingly as a drag on economic growth. The adoption of exchange control in 1930 was mainly motivated by a desire to defend the external value of the Iranian currency, and to ensure the development sector of an adequate supply of foreign exchange. But in the period 1930-1936, when the currency continued to be based on silver, the fixed official rate of exchange was only nominal, and the "effective" exchange rate was influenced mainly by changes in

the world price of silver. Failing to go off the silver standard, the government had to abandon its attempts to control, effectively, the rate of exchange. Trade controls were retained; but as these were implemented in a way that permitted some degree of flexibility, the restrictive effects were not too great at this early stage.

After 1936, when exchange control was reintroduced and enforced vigorously, its adverse effects on the economy were more pronounced. Besides the official rate which grossly overvalued the rial, there were a number of "effective" multiple exchange rates which resulted from the classifying of imports and exports into several categories. These de facto rates were freely fluctuating, and this tended to increase the risk and hence reduce the gain from international specialization. Also, as the difference between the official and the equilibrium rates widened, exports receiving only the official rate were discouraged and imports unduly encouraged. Hence, administrative controls (quotas and licensing) had to be intensified.

One effect of quantitative controls was to encourage bilateral trading with Russia and Germany who, by overvaluing their own currencies still further, succeeded in achieving monopolistic exploitation in trade with Iran. The other effect was to distort the structure of prices and thus impair the efficiency of the economy.

With a view to future course of policy it was found that the country can promote growth through the imposition of a proper infant industry tariff, which provides both the necessary incentive to invest and the saving needed to finance this greater investment; and it was indicated that a substantial increase in earnings from oil should make it possible for Iran to undertake a large investment program without resorting to severe quantitative controls.

240 pages. $3.10. Mic 57-96

EDUCATION

EDUCATION, GENERAL

THE READING DIFFICULTY OF A SELECTED SET OF LEADING MASS MAGAZINES

(Publication No. 19,612)

Marcus Thomas Allias, Ph.D.
University of Pittsburgh, 1956

Magazines, because of their number and variety, have played an important part in the history of our country. They have distributed important information; they have influenced opinion on public questions; they have brought about social and political reforms; and, through the medium of advertising and editorial content, they have effected the American way of life by raising the standard of living for all Americans. When their influence is considered, it is amazing to learn that so few studies have been made concerning the readability of magazines. Therefore, it was the intent of this study to explore a selected set of mass magazines with the main interest centered on readability.

The growth of literacy during previous centuries was discussed, and an attempt was made to account for the widening of the reading public. Since there was no written history of the origin and development of the types of mass magazines used in this study, this history was sketched in. In addition, the readership of these particular mass magazines was analyzed and a presentation of related research was made.

The main purpose of the study was to examine vocabulary load, or reading difficulty, as an aspect of the readability of a selected set of mass magazines in the light of their history and readership. The Yoakam Readability Formula, based wholly on vocabulary load, which authorities in the reading field consider an adequate factor, was used to determine the readability of these magazines.

The selected magazines were arranged according to type and measured for the purpose of determining levels of difficulty, range of difficulty, and concentration of difficulty.

The following conclusions resulted from the study:

1. The selected mass magazines range in difficulty from a reading grade level of 8.0 to 13.6.
2. The median difficulty of the overall list is 10.8.
3. Further research in magazine history is necessary before any connection between magazine's date of origin and readability can be determined.
4. Only eight per cent of these magazines rated within the eighth-grade level of difficulty. Twelve per cent rated within the ninth-grade level; 36 per cent within the tenth-grade level; 28 per cent within the eleventh-grade level; four per cent within the twelfth-grade level; and 12 per cent above the twelfth grade level.
5. There was a steady rise of difficulty within each type group of magazines, and no two magazines within the same group had the same grade level.
6. There was a wide range of difficulty among the seven type groups and no two different type groups had the same grade level.
7. The median difficulty of the behavior type magazines was 9.0, which was 1.8 below the overall median difficulty.
8. The median difficulty of the science fiction magazines was 11.7, or 0.9 above the overall median difficulty.
9. The popularity of magazines which rated either above their group median or the overall median may have been due to interest in content, not readability.

The following general conclusions were indicated:

1. Most of the selected mass magazines were written within the tenth- and eleventh-grade levels of difficulty.
2. The median difficulty of the magazines measured was 10.8, one-tenth point less than the 10.9 median educational age for major occupation groups.
3. Of the selected magazines, 52 per cent were below, four per cent were equal to, and 44 per cent were above the median educational age for major occupation groups.
4. The following examples from the results of this

study suggest that, judging from magazine circulation, the wage earner is capable of reading beyond his educational age: Sport, Amazing, and Motion Picture, (11.1); True Detective (11.6); Confidential (13.1); Stag (13.3); Astounding Science Fiction (13.6).

100 pages. $1.50. Mic 57-97

GUIDANCE SERVICES IN KANSAS PUBLIC SECONDARY SCHOOLS

(Publication No. 19,484)

Clyde Ray Baird, Ed.D.
The University of Oklahoma, 1956

Chairman: F. F. Gaither

Kansas was one of the first states to follow federal leadership in the area of guidance by appointing a State Supervisor of Guidance Services. In view of the fact that no comprehensive study of guidance services in Kansas had been made, it seemed worthwhile to study and to report the status of such services in the public secondary schools. It was the purpose of this research to make a comparative study of guidance services in first class, second class, and third class public secondary schools of Kansas as reflected in a survey of current practices.

This study was limited to public schools because the use of federal vocational education funds which contribute to the maintenance of guidance activities is limited to agencies under public control. It was limited to secondary schools because state leadership has emphasized the development of guidance activities at this level. This emphasis on secondary school guidance is a reflection of the trend in development at the national level of leadership and in the growth and promotion of guidance programs throughout the United States as an adjunct of vocational training.

The normative-survey type of research was used with two questionnaires prepared and distributed to schools reporting guidance programs to the State Department of Public Instruction. One questionnaire was sent to all counselors in Kansas public secondary schools in order to obtain information relative to professional qualifications plus additional academic and work experience background. Information was sought from these individuals concerning the kinds of services rendered to students in groups and as individuals. Another questionnaire was submitted to administrators whose schools had guidance programs, and it was concerned primarily with the administrative bases of such programs. Replies were received from 81 percent of the counselors and from 86.5 percent of the administrators.

An analysis of the responses warrants the following conclusions:

1. Guidance programs in Kansas public secondary schools may be considered as typical programs since they appear to be patterned on recommended principles and procedures. Such programs tend generally to have administrative support and to have professional guidance leadership.

2. The guidance programs usually provide the services recommended as being desirable, but there are weaknesses in placement services and follow-up services, the latter being a very neglected area.

3. Counselors in Kansas public secondary schools are reasonably well-trained and appear to have the professional background frequently recommended. They also have considerable work experience outside the teaching field.

4. Guidance programs in third class schools are often weaker than those in first and second class schools. This is noted in almost all areas of administrative and professional guidance leadership and in the extent of services offered.

170 pages. $2.25. Mic 57-98

A CRITICAL ANALYSIS OF SELECTED RESEARCH LITERATURE ON THE PROBLEM OF SCHOOL DROPOUTS

(Publication No. 19,613)

Telford Benjamin Blough, Ed.D.
University of Pittsburgh, 1956

The critical analysis of selected research literature on the problem of school dropouts was undertaken with the object of presenting findings, conclusions, and generalizations which will help in the solution of the problem. A secondary objective was concerned with discovering practices which will facilitate acceptance of common terminology, definitions, standards of pupil accounting, and methods of research.

Examination of standard indexes, the active assistance of the U. S. Office of Education and the NEA Division of Research, and correspondence with state departments, graduate schools, local districts, and interested individuals resulted in a bibliography of 476 cited references and 325 supplemental references. The list of cited references is comprehensive, dating from 1872 to June, 1956. Distribution by approximate date of publication follows: Before 1920, 56; 1920-1929, 51; 1930-1939, 111; and 1940 to date, 258. Since comprehensive bibliographies of dropout research were not available, it is believed that this listing is a coincidental contribution toward a solution of the dropout problem.

Bibliographic materials were analyzed, tabulated on master charts, and collated to isolate the findings. Findings are summarized in 58 tables and discussed with comprehensive documentation and direct quotations. The study is documentary-analytical and, therefore, largely a quantitative evaluation. Qualitative studies might result in somewhat different conclusions.

The review of research literature supports several basic assumptions. First, the ideal of a high school education for all normal American youth is accepted with few dissenting voices. Second, with a national dropout rate of 45 per cent, the ideal is far from realization. Third, there is a dropout problem, but holding power can, by cooperative efforts, be improved.

Slightly more than 50 per cent of the researches were concerned with factors, reasons, or causes associated with pupils dropping out of school. The writer selected "factors associated with dropping out of school" as the better concept, since a basic difficulty of dropout research is the inability of researchers to establish direct causal

relationships. Factors associated with dropping out of school are "numerous, varied, and complex."

When major categories associated with pupils dropping out of school are ranked according to frequencies (per cents) of mention, the results are as follows: (1) Home, 26.6; (2) Pupil attitudes, 20.7; (3) School progress, 19.0; (4) Personal factors, 17.5; (5) The school, 10.9; (6) The community, 5.3. When the 41 factors are removed from the major categories and ranked by frequency, the first eight follow in rank order: (1) Socio-economic status, (2) Financial need, (3) Preferred work, (4) Mental ability, (5) Lack of interest, (6) Retardation, (7) Parent attitude, and (8) Failure.

Suggestions for reducing dropouts by improvement, change, or addition to present programs, based on frequency of mention, assume this rank order: (1) Curriculum, 36.8; (2) Pupil personnel services, 34.9; (3) Instructional, 17.9; (4) Administration and organization, 8.8; (5) Community, 1.6. When suggestions are ranked independently, the most frequently mentioned are as follows: (1) More flexible curriculum, (2) Individual counseling, (3) Special courses or classes, (4) Industrial-vocational courses, (5) Understanding and sympathetic teachers, (6) More practical courses, (7) Home-school visitors, (8) Extracurricular activities, (9) Courses adapted to the individual, and (10) Better pupil records and accounting.

This revised definition of the Dictionary of Education is likely to be accepted generally: "Dropout—a pupil who leaves school before graduation, as in the case of many high school pupils who drop out of school upon reaching the age of voluntary attendance."

While problems of research, tied closely to inadequate technical terminology and lack of standardized procedures in pupil accounting, are many, it is believed that more positive leadership on the part of the U. S. Office of Education, NEA, state departments of public education, and graduate schools is doing much to correct the difficulties.

Interaction is the key word to the total problem of school dropouts: discovering factors or effecting improvement in holding power. 376 pages. $4.80. Mic 57-99

THE FACTORS OF PREFERRED TEACHERS' SALARY SCHEDULES APPLIED TO TEACHERS' SALARY SCHEDULES OF THIRD CLASS SCHOOL DISTRICTS IN PENNSYLVANIA

(Publication No. 19,617)

Edward P. Cibik, Jr., Ed.D.
University of Pittsburgh, 1956

This is a study to determine the factors of preferred teachers' salary schedules and to apply these factors to the teachers' salary schedules of third-class school districts in Pennsylvania. A bibliography was compiled of those authorities in school administration who have written complete articles about teachers' salary schedules. Each article was read, summarized, and each factor of preferred teachers' salary schedules was ranked according to the frequency of mention for each factor. The other criterion for the factors of preferred teachers' salary schedules were the salary schedules obtained and analyzed from ten selected cities, of a size comparable to Pennsylvania's third-class school districts, in the United States with outstanding salary schedules.

Each of the third-class school districts in the State of Pennsylvania was contacted, and of the 258 districts responding, 85 indicated that they have a teachers' salary schedule, and submitted their salary schedule. Each teachers' salary schedule was analyzed, and the factors were ranked according to their frequency of mention. Tables were constructed to indicate various provisions contained with the factors.

The factors of preferred teachers' salary schedules were compared with the factors contained in the teachers' salary schedules analyzed from Pennsylvania's third-class school districts. The 38 factors of preferred teachers' salary schedules determined from the writings of authorities are minimum salary, maximum salary, increments, equal pay for equal service, professional training or preparation, salary classes, advanced professional training or preparation, credit for prior service, merit or supermaxima, salaries for special teachers, basic explanatory statements, advancement or reclassification, retirement, extra pay for extra duty, salary schedule committee, transition to new salary schedule, cost-of-living adjustments, dependency allowances, placement of teachers, appointment of teachers, sick leave, leaves of absence, flexibility, salary adjustment for men, credit for military service, salaries for substitutes, in-service growth, method of payment, minimum qualifications, term of employment, probationary period, medical care and hospitalization, group insurance, expense accounts, discipline of teachers, credit unions, teacher-exchange program, and dismissal of teachers. Twenty-three of the same factors were located in the salary schedules of ten selected cities in the United States with outstanding salary schedules. The number of factors determined from the salary schedules of Pennsylvania's third-class school districts is 37. Four additional factors were found in the teachers' salary schedules from Pennsylvania's third-class school districts which are effective date of schedule, service supermaxima, salary deductions, and loyalty oath. This comprises a total of 42 factors which are either factors of preferred teachers' salary schedules or factors of the teachers' salary schedules of third-class school districts in Pennsylvania.

The results indicate that there are five factors of preferred teachers' salary schedules which are contained by 85 per cent or more of the teachers' salary schedules of Pennsylvania's third-class school districts. These five factors are minimum salary, maximum salary, increments, equal pay for equal service, and salary classes.

The third-class school districts in Pennsylvania have tended to adhere to the State mandated salary schedule without applying the factors of preferred teachers' salary schedules. Certain factors of preferred teachers' salary schedules are not given significant consideration in salary schedules of Pennsylvania's third-class school districts—such factors as professional training or preparation, merit or supermaxima, salaries for special teachers, and others, while the opposite is true concerning other factors; and some factors are given equal consideration. Some factors of preferred teachers' salary schedules might better be combined. The medians for the minimum and maximum salaries from Pennsylvania's third-class school districts are still low in comparison with the medians of the minimum and maximum salaries of preferred teachers' salary schedules, although still higher than the minimum and

maximum salaries of Pennsylvania's mandated salary schedule. 271 pages. $3.50. Mic 57-100

A STUDY OF VALIDITY AND RELIABILITY OF STUDENT EVALUATION OF TRAINING

(Publication No. 17,183)

Henry James Duel, Ed.D.
Washington University, 1956

Chairman: Dr. Charles A. Lee

The purpose of the study is to explore the validity and reliability of student self-evaluation as a method of appraising the effectiveness of a course of instruction.

This study was conducted in three Air Force Technical Schools. Since objectives of these schools were primarily those of skill and knowledge development, a reliable and valid measure of the gain made by students in skill and knowledge would give an indication of the effectiveness of the course of training. The study was limited to an exploration of the validity and reliability of students' self-evaluation of their gain in skill and knowledge in a technical course.

The methods used in the study involved the determination of reliability and validity of student evaluation by use of a Student Evaluation of Training form (SET). This form was administered to students at the completion of a course of instruction. It required the student to make an estimate of the level of skill he possessed at the time of entrance into the training course as well as the skill level he possessed upon completion of the course. The result is a student self-evaluation of his gain in skill or his achievement in the course. Items on the SET were specific skills taken from the Syllabus for each course and thus represent specific objectives of the course. Estimates were made on a nine point scale and the difference between the two estimates on each item represented the student's evaluation of his gain in skill during the course. Reliability coefficients for the SET forms were determined by the test-retest method. Coefficients of validity for the student self-estimate were determined by comparing the SET gain score with an actual measure of gain obtained by use of reliable and valid pre-tests and post-tests.

Reliability coefficients obtained for the SET, as determined by test-retest, ranged from .65 to .84. Correlations between SET gain scores and residual gain were determined by the method of part correlation. Part correlations between SET gain and post-test, with variability associated with pre-test removed, ranged from .47 to .64. Study of several of the scattergrams, showing SET gain score and pre-test post-test gain scores, indicated that the best students tended to underrate and the poorest students, to a greater extent, tended to overrate their achievement.

Study of the obtained results indicated that the SET was a sufficiently reliable instrument for the purpose for which it was intended. Testing by the null hypothesis showed all part correlations were significant beyond the one per cent level of confidence.

Conclusions of the study may be summarized as follows:

1. Students can make reliable and valid self-judgments concerning the skill and knowledge gain which they achieve in technical courses such as those presented in this study.
2. Good students tend to under estimate and poor students to over estimate their achievement.
3. All validity coefficients obtained for self-evaluations by students, as correlated with the criterion of residual gain, were significant at the one per cent level of confidence. Thus, student evaluations in this case can be considered to be valid measures of student achievement.
4. At the time of completion of a course of instruction, students can reliably estimate the skill or knowledge possessed by them when they entered the course.
5. The results of this study demonstrated that self-evaluation by students can be effectively accomplished at the action level.

112 pages. $1.50. Mic 57-101

AN ANALYSIS OF FIFTY GRADE CHILDRENS' RESPONSES TO GOAL-INTERFERENCE SITUATIONS

(Publication No. 17,797)

Ralph Leonard Duke, Ed.D.
University of Maryland, 1956

Supervisor: Dr. John J. Kurtz

Purpose of the Study

The purpose of this study is to determine the relationship of selected personal characteristics of elementary school children such as sex, ordinal position in the family, school success, status in the peer groups, and membership in boy-girl organizations, to the patterning of their responses to goal-interference situations.

The study has been developed around five hypotheses:

1. There is a significant difference in the way fifth grade boys respond to goal-interference situations and the way fifth grade girls respond to the same situations.
2. There is a significant difference in the responses to goal-interference situations of children holding different positions in the family constellation.
3. There is a significant difference in the way children respond to goal-interference situations on the basis of school success.
4. There is a significant difference in the way children, holding high status with their peers respond to goal-interference situations and the way children holding low status will respond.
5. Membership in boy-girl organizations influence the way children respond to goal-interference situations.

Procedure of the Study

The data for this study were secured through a projective type test, administered to groups of fifth grade children. The responses thus secured were analyzed by a system of categorization. To test the hypotheses the response categories were related to personal characteristics of the subjects and differences in responses were determined.

Results of Analysis of Data

Analyzing data and testing for significance through application of chi-square, it was found that hypotheses 1, 3, 4, and 5 were clearly tenable and that hypotheses 2 was unsupported by the evidence.

There are evidences that children are consistent in their approach to goal-interference situations, and that they are inclined to respond like other children with whom they share common personal characteristics. Girls, children working above and at grade level, high status children, and members of boy-girl organizations tend to exhibit more mature behavior in conflict situations than do boys, children working below grade level, low status children, and non-members. No relation between ordinal position in the family and maturity of behavior in goal-interference situations was established.

Since the most significant difference in the behavior of the subjects was noted among the groups working at the various levels of school success it might be implied that success contributes greatly to the feeling of adequacy with which a child faces problems in everyday living. Other factors contributing to maturity in behavior are related to his feeling of security, or belongingness, with others. Thus it would seem that experiences which contribute to a child's feeling of success and security would aid him in learning the skills needed for making adequate adjustments in everyday life situations. 170 pages. $2.25. Mic 57-102

A STUDY OF THE STUDENT DROP-OUT PROBLEM AT MIAMI UNIVERSITY

(Publication No. 19,272)

Robert Irwin Goble, Ed.D.
Indiana University, 1956

Chairman: Howard T. Batchelder

The major objective of this study was to compare the scholastic and personal characteristics of a group of students from the Miami University September, 1950 freshman class who withdrew prior to graduation with those of a group matched in age, sex, and American Council on Education Psychological Examination scores who continued on to graduate by June, 1954. The findings were evaluated in terms of their significance both for the improvement of the educational program and the development of a more successful guidance and counseling service.

Information was obtained by use of both questionnaire and interview techniques. In addition, data from the files in the offices of the registrar and the student counseling service were recorded on an office form developed for that purpose. A random sample of 15 per cent of the drop-out students living in Butler, Hamilton, and Montgomery Counties, in Ohio, yielded 23 usable interviews. Questionnaires were sent to the remaining 849 students who had withdrawn prior to graduation; and from this group, 197 responses were considered usable for this study. From the 496 graduates of this class, it was possible to match in age, sex, and ACE scores a total of 65 men and 75 women, contacted by questionnaire, and 11 men and 12 women, contacted by interview. This led to a study of 326 persons, or 22 per cent of the original class of 1473 students.

Analysis of the results of this study seemed to indicate the following main conclusions: (1) The class that started as freshmen at Miami University in September, 1950, represented an about normal class as revealed by the American Council on Education Psychological Examination scores. (2) Since less than half of the drop-outs had attained a cumulative grade point average of 2.0 (C = 2) at the time of withdrawing, it was apparent that a causal relationship existed between student mortality and deficiency in academic achievement. (3) Of the reasons given for withdrawing from school, military service for men and marriage for women were given most frequently. (4) More students coming from the higher quartiles of their high school graduating classes continued on to graduate and achieved higher grades in college than those from the lower quartiles. (5) Graduates reported much greater participation in college activities than did drop-outs, suggesting a less complete integration of all aspects of college life for those students who withdrew. (6) The influence of military service on the course of employment of the men studied, following both withdrawal and graduation, was such as to obviate any conclusive proof of influence which the completion of college work had on the types of occupations held. For the women, the much larger percentage of graduates reporting positions of a professional or managerial nature clearly indicated the influence of their completed college work. (7) More graduates than drop-outs reported that they felt their college work had been of value; but, even among the withdrawees, a large number felt that it had helped them to some extent. (8) It appeared that the drop-out group had a less desirable relationship with their advisers than was true for the graduates. (9) The frequent expression of the opinion that advisers had too many advisees seemed to indicate a failure of the present system to provide sufficient individual help. (10) No significant relationship could be established between persistence in college and age at matriculation, type of residence on the campus, or the need to work to remain in school.

As a result of the study findings, six recommendations for the improvement of the guidance services were made. 220 pages. $2.85. Mic 57-103

A STUDY OF THE READABILITY OF HIGH SCHOOL BUSINESS LAW TEXTBOOKS

(Publication No. 19,627)

David Gerson Goodman, Ed.D.
University of Pittsburgh, 1956

This is a study to determine the grade placement of high school business law textbooks, published between the years 1930 and 1955, by applying the Yoakam Readability Formula. An additional objective includes the preparation of a word list of legal terms which can serve as a basis for directed vocabulary study in business law classes.

The words encountered in this study by applying the Yoakam Formula to 28 high school textbooks were screened to avoid duplications and then subjected to an unabridged dictionary to determine those which had a specific legal meaning. The legal words were then submitted to a competent jury of 20 business law teachers and to a jury of 20 successful lawyers to determine which words were of value to a well-informed citizen.

The results of the study indicated that the grade placement of the 28 high school business law textbooks ranged from 9.0 to 12.8 grades. Most of the textbooks would be placed within the comprehensibility of the average reader of the twelfth grade, and 67.9 per cent of the textbooks would not be too difficult for most of the eleventh-grade students. Twelve of the textbooks may contain reading matter that is too easy for most of the twelfth-grade students, but only 14.3 per cent may be too easy for most of the eleventh-grade students.

There is no significant trend in the readability level of the textbooks throughout the years studied; however, there is a slight increase in the grade level during the last 15 years.

On the whole, the legal words and the nonlegal words of the books show only slight differences in difficulty. It would appear, then, that much of the reading difficulty is caused by the general vocabulary of the textbooks in that the 361 legal words constitute only 16 per cent of the 2,265 separate words scored.

Business law teachers indicate that they believe more than 75 per cent of the 361 legal words are of great value to the citizen and therefore should be taught. Lawyers consider more than 73 per cent of the legal words to be of great value. Both lawyers and business teachers agree that the meanings of 58.4 per cent of the words with specific legal definitions are of great value to the citizen. These words should provide the nucleus of a vocabulary for business teachers and students. Both juries agree that 68 words are of only some value or of no value to the citizen.

Observations from reading and scoring the textbooks suggest the possibility that much of the difficulty encountered by students is found in the wording of the illustrations of the legal principles rather than in the wording of the principles themselves.

It would seem important that teachers, who would provide for the varying reading abilities of students, select differently graded textbooks for use in a single class rather than adopt just one textbook for all to use.

Although vocabulary load has a major part in the determination of a readability level, the attempt to make a book less difficult by the elimination of the more difficult words, alone, does not seem logical. Certain single words may more accurately and interestingly explain information than would a series of easier words. Actually, factors other than vocabulary have an important bearing on whether or not a textbook is of the right grade level for a particular class. These other factors should be permitted to exert an influence on the teacher's decision.

Specific vocabulary training of both the legal and the general vocabulary should be designed and emphasized throughout the course. 109 pages. $1.50. Mic 57-104

THE RELATIONSHIP BETWEEN SPEED OF VISUAL PERCEPTION AND BASIC SKILL IN TYPEWRITING

(Publication No. 19,630)

Robert Lowell Grubbs, Ed.D.
University of Pittsburgh, 1956

The determination of the statistical relationship between speed of visual perception and basic skill in typewriting was undertaken with three objectives. The first of these was to determine the degree to which variation in speed of visual perception was accompanied by variation in speed and accuracy of typewriting. Because the ability to see quickly seemed so evidently to depend upon normal visual fitness, a secondary objective of this investigation was to ascertain whether or not normal visual ability, or the lack of it, was reflected in rate of visual perception. The last objective was to determine the relationship between visual fitness and basic skill in typewriting.

The significant elements of the problem centered around the statistical evaluation of the data resulting from the administration of tests of speed of visual perception and typewriting skill to 446 high school students enrolled in classes in typewriting.

Speed of visual perception was measured by exposing a series of 52 numbers and 52 phrases on a screen, item by item, at seven decreasing intervals of exposure time ranging from one second to 1/100 of a second. Basic skill in typewriting was determined by administering three 5-minute writings on straight-copy material. To ascertain the role of visual fitness in achievement on these tests, 64 of the students scoring highest and 58 of the students scoring lowest in speed of visual perception were given visual fitness examinations with an Ortho-Rater. The examination consisted of tests of phoria, acuity, stereopsis, and color discrimination.

The presence of a positive but slight relationship between basic typewriting skill and speed of visual perception was found. Twenty-four coefficients of correlation were computed based on six arrangements of the data. Positive values ranged from a low of .058 to a high of .403.

Fifty of the 122 subjects examined for visual fitness were found to have desirable or adequate visual abilities. Of the 72 subjects with below-desirable vision, 17 were found to have one or more visual deficiencies that were determined as seriously low. However, a comparison of performances based on high and low groupings indicated that visual fitness apparently had little if anything to do with speed of visual perception scores.

The presence of a slight relationship between visual fitness and basic typewriting skill was found. Bi-serial coefficients of correlation between words a minute in typewriting and the classifications of desirable vision and below-desirable vision ranged from a low of .16 to a high of .23.

The findings of this study indicate that there is some relationship between speed of visual perception and basic skill in typewriting. However, the strength of the relationship provides scant basis for the assumption that improving the perceptual speed of typists will result in a consequent improvement in typewriting skill.

Upon the basis of the findings, performance in speed of visual perception, as well as in typewriting, seemingly is not completely dependent upon visual fitness. Perhaps speed of visual perception is a distinct performance characteristic of the visual process not necessarily dependent upon or related to acuity, phoria, stereopsis, or color discrimination. 111 pages. $1.50. Mic 57-105

FACTORS RELATED TO THE COLLEGE CHOICES OF AKRON HIGH SCHOOL GRADUATES IN 1951

(Publication No. 19,700)

Frank Glenn Ireland, Ed.D.
University of Michigan, 1956

This study inquires into the reasons why 224 students, who graduated in 1951 from eight public high schools in Akron, Ohio, and who later went to college, selected the particular colleges in which they initially enrolled. Most of them enrolled at the University of Akron, hence our major assumption:

From the Akron high schools the University of Akron draws a distinctive student body which measurably differs in certain characteristics from the characteristics of students who enroll elsewhere.

Five minor assumptions were also set up involving the mean high school achievement of those who enroll at the University of Akron and those who enroll elsewhere; the student's socio-economic status; the educational "design" of the University of Akron; variant college curricula, and the effectiveness of formal guidance in high school in the determination of choice of college.

A College Choice Inventory sheet was devised from 627 replies to a questionnaire received from students at the University of Akron and Kent State University. It contains 40 items or reasons for selecting these two schools. In turn this Inventory was sent to 341 college-going graduates of Akron public high schools in the fall of 1951. There were 224 replies or a 66 per cent return. Items were checked in 1,2,3, choice order.

The findings are as follows:

1. The University of Akron draws a student body with a higher mean of scholastic averages than Kent State University. It does not draw a student body superior in scholastic averages to those who go to larger institutions (5,000 students or more) exclusive of Kent State University. There was no significant difference in scholastic averages when state schools, small schools, and private schools were individually grouped.

2. The student's economic status does bear a significant relation to the cost of attending college as a factor in college selection. The University of Akron draws its students largely from the Lower Middle and Upper Lower economic classes. Cost of Attending and Proximity were the items most frequently checked on the College Choice Inventory.

3. The educational "design" of the University of Akron did not appear to be an important determinant of college selection.

4. Variant college curricula at the University of Akron and Kent State University do not play a major role in college selection.

5. Formal guidance received in high school was less effective than other agencies in the determination of choice of college. More students attending the University of Akron received guidance than those enrolling elsewhere.

From these conclusions it can be inferred that in some respects the University of Akron does draw a distinctive student body from the Akron public schools: these high school graduates have a high mean scholastic average; they come from middle class homes; they receive more college counseling in high school; a larger number work while in college; and by their own testimony they recognize the high academic rating of their "home town" university. 213 pages. $2.80. Mic 57-106

A FIELD INVESTIGATION OF THE CO-OPERATIVE BUSINESS OCCUPATIONS PROGRAM IN THE MIDLAND (MICHIGAN) HIGH SCHOOL

(Publication No. 19,704)

Frank Wesley Lanham, Ph.D.
University of Michigan, 1956

PURPOSE

The purpose of the investigation is to evaluate the co-operative business occupations program, a type of supervised work and study, as practiced in the Midland (Michigan) High School. The proof of three hypotheses is involved. It can be demonstrated in practice that:

1. co-operative business education is a school program applicable to groups of pupils possessing a wide range of differing abilities;

2. the experiences obtained meet important growth and developmental needs of pupils enrolled in the program; and,

3. co-operative experiences can be applied without compromising other educationally sound objectives.

The value of the investigation stems from the promise of an added program to implement secondary school curriculum experiences to meet the needs of an increasing number of enrolled pupils.

SCOPE

To help determine the attitudes and feelings of participants in this type of supervised work and study program, 189 former participants in the Midland co-operative business program answered a preliminary questionnaire by mail. From tabulated responses to one of the questions, ten of the classified items regarding school and work appeared unique to a co-operative type program. In a revised questionnaire, these ten items were placed in a check list question to determine in a more specific way whether the apparent differences were real. The revised questionnaire was completed by 69 graduates of Midland High School, 38 of whom had followed a co-operative business program and all of whom were employed in the offices of one of the chemical industries. Similar opinions about the school and work phases of the program were obtained in a group interview situation from 105 pupils following the co-operative program in 1952-53. As a follow-up of these data, personal interviews of eleven graduates from the program were recorded and transcribed.

Personal information in the form of standardized test scores and scholastic marks were obtained from school records for members of the class of 1952-53, co-operative business pupils and all others, 367 in total; and for respondents to the questionnaires. Additional data were obtained through two administrations of Hicks' Business Vocabulary Test to 309 pupils of the same class.

CONCLUSIONS

Through standardized test scores and scholastic marks, it was demonstrated that the program as operated at

Midland High School is applicable to groups of pupils possessing a wide range of differing abilities.

From the opinions and indications of feelings and attitudes about the experiences obtained from questionnaires, group interviews, and personal interviews, it was demonstrated that co-operative business education does effectively meet important growth and development needs of most pupils enrolled. The job laboratory provides experiences that cannot be duplicated in the school classroom. The greatest changes in pupils were observed in the area of personal relations with other people, development of poise and confidence, and the development of wholesome job attitudes.

Scholastic achievement, as measured by school marks and by the results of Hicks' Business Vocabulary Test scores, was not affected adversely by participation in the co-operative type program. Pupils enrolled in the program participated in fewer extracurricular activities than others. There was evidence to indicate, however, that the program appealed to those who did not engage in extracurricular functions before entering the program.

Guidance facilities appeared to be equally available to co-operative pupils as to others. The co-ordinator and employer representative were two sources of help available to co-operative pupils and not to others.

While some educational experiences were obviously replaced by those of the co-operative program, the evidence indicated that any encroachment in meeting other sound educational objectives was more than offset by other gains to the pupil. 337 pages. $4.35. Mic 57-107

THE RELATIONSHIP BETWEEN READABILITY AND COMPREHENSION OF HIGH SCHOOL PHYSICS TEXTBOOKS

(Publication No. 19,382)

James Stanley Marshall, Ph.D.
Syracuse University, 1956

The purpose of this study was to determine the relationship between the readability and comprehension of high school physics textbooks. The design of the experiment called for setting up two groups of high school physics students which had been equated on reading comprehension and physics aptitude. The first group read a physics passage taken from one of the standard textbooks, commonly used in the high schools of New York State; the second group read a reconstructed version of the same passage which had been altered by having its readability score raised appreciably. Then both groups were given the same test of comprehension covering the passages. Finally, the scores of the two groups were compared and analyzed.

The information on textbooks used in New York State was obtained from data on file in the office of the State Supervisor of Science. These data showed that 90 percent of the high schools giving physics courses use only seven different textbooks. These seven books were tested for readability and a typical passage from one of the books was selected for the experiment.

The instrument selected for determining the readability of the textbooks and as the basis for rewriting the experimental passage was the Flesch Reading Ease formula. This choice was based upon the belief that the elements in the Flesch formula, namely average sentence length and number of syllables per hundred words, are among the best of the available predictors of reading difficulty.

In rewriting the passage selected for the experiment, the attempt was to change only the sentence length and number of syllables per hundred words and to hold constant all other factors which might influence readability. The rewritten passage thus had a Flesch Reading Ease score of approximately 65, whereas the score of the textbook passage was approximately 47. This placed the two passages at the level of the ninth and thirteenth grades respectively.

The instruments used to test the subjects on reading comprehension and physics aptitude were the Cooperative Reading Comprehension Test and the Cooperative Physics Test. On the basis of their scores on these tests, the subjects were divided at the medians of the entire sample into good and poor reading groups and good and poor physics groups. All possible combinations of these four groups were established, resulting in a typical 2 x 2 factorial design. Then each of these groups (cells) was divided into two equal sub-groups for the purposes of the experiment. This classification into eight cells resulted in a 2 x 2 x 2 factorial design. The most practical and profitable way to analyze the comprehension test scores in such a design was by an analysis of variance.

The analysis of data showed that the students who read the rewritten passage did not perform significantly better on the test of comprehension than did the students who read the unaltered textbook passage. This was the major finding of the study. The good readers performed significantly better than the poor readers on the comprehension test regardless of which passage they read; the same thing was true of the good physics students. No significant interactions appeared.

The major conclusion of the study is that the Flesch Reading Ease formula does not predict difficulty in the comprehension of high school physics textbooks. It is true that the Flesch formula and others are widely used for estimating the reading difficulty of physics and other science books. There is, however, little, if any, experimental evidence to justify such use. The major readability formulae have been developed with the use of non-scientific non-technical material as reading and comprehension criteria.

The major recommendation is for authors, publishers, teachers, and others to limit the use of the Flesch Reading Ease formula to the kinds of materials for which they were evidently developed and intended; or if this formula and others have some use with technical reading materials, to justify such use with experimental evidence. And, inasmuch as this study is one of the few which attempts to apply a readability formula to science reading material, a secondary recommendation is for other investigators to attempt research from a variety of directions. The application to science materials of a wide variety of elements which various students think may affect readability will, in time, bring about science reading materials that are more readable. 127 pages. $1.70. Mic 57-108

TEACHER AND PUPIL JUDGMENTS OF INTERPERSONAL RELATIONS IN THE CLASSROOM

(Publication No. 19,906)

Kenneth Livingstone Meeks, Ed.D.
Stanford University, 1956

1. Statement of the problem:

The main problem of this study is the extent of agreement between teachers and pupils in their judgments of interpersonal relations in the classroom. Two related problems, along with the main problem, constituted the nuclei around which the data gathering, interpretation, and conclusions were centered. The two related problems were: (1) "What factors seem to form the bases upon which teachers make their judgments concerning the interpersonal relations of their pupils?" and (2) "What factors seem to form the bases upon which pupils make their judgements of interpersonal relations?".

2. Procedures:

The personnel studied and from whom the data were drawn consisted of five elementary school teachers and their respective 188 pupils. Pupil popularity was selected as the item around which to center the data gathering.

Teachers selected pupils they perceived as "most and least popular", pupils they considered themselves to be "most and least effective" with, pupils they considered to be "best and least well adjusted", and pupils they "liked personally" and those toward whom they had "negative feelings".

Pupils were given two sociometric tests. The first of these tests, the "Whom Do You Like Best" test, asked four questions relative to their choices of classmates in both in and out of school situations. From pupil responses to this test, sociograms were constructed in order to assess the acceptance given pupils by fellow members of the class. First choices were worth two points, second choices were worth one point. From the weighted choices a compilation was made of each class. The study defined the five pupils in each class who received the highest numerical value on the compilation as "most popular". Conversely, the five pupils who received the lowest numerical value on the compilation were defined as "least popular" in each class.

The "Guess Who" test given the children revealed the status reputation of pupils as perceived by those who placed the names of various pupils beside the various positive and negative statements on the test. Teacher and pupil choices were described by the information supplied by this test.

Teacher and pupil choices were comprehensively studied and analyzed in an effort to seek out factors which seemed to provide the bases upon which teachers and pupils made their choices.

3. Results:

(1) Teachers displayed moderate ability in being able to identify the same pupil as their classes did as "most popular". (2) Teachers' definitions of "adjustment" tended to describe the same children they designated as "most popular". (3) Teachers tended to repeat their choices of "most popular" pupils under the positive characterizations in the other three categories in which they chose pupils. (4) Socio-economic level or ethnicity of pupils did not influence choice-making to any marked degree on the part of either teachers or pupils. (5) Teachers and pupils recognized in their choices the more obvious success-features which are accepted and highly regarded in the American culture.

251 pages. $3.25. Mic 57-109

IMPLICATIONS OF LIBERAL ARTS TRAINING AT DEPAUW UNIVERSITY AS IT RELATES TO THE VOCATIONAL SUCCESS OF SELECTED MALE GRADUATES

(Publication No. 19,280)

David Walter Robinson, Ed.D.
Indiana University, 1956

Supervisor: G. Bomen

Problem. This study was designed to make an analysis of certain experiences male alumni of DePauw University had during and after their campus life and to collect and evaluate opinions held by these men about aspects of their college and vocational experiences. It was held that this study would contribute information for the personnel administrators at DePauw University to aid them in rethinking their program of educational and vocational counseling.

Procedure. A questionnaire prepared especially for the study was mailed to living alumni who received a bachelor of arts degree at DePauw University in graduating classes 1936 through 1951. Usable replies were received from 66.9% of the sample. The data from the replies and data about the academic rank in their respective graduating classes were punched on IBM cards, processed, and tabulated in form of percentages for the descriptive portion of the study.

Major Findings.

1. The alumni in the sample appeared to be representative of all male alumni of DePauw University who graduated during the period studied.
2. Over twice as many men earned degrees in the social sciences as in the humanities or natural sciences.
3. Almost three-fifths of the men attended graduate school. Those who graduated in the upper parts of their classes made up the majority of this number.
4. The average DePauw alumnus worked for 2.1 employing concerns since graduation, the majority of them employed in business.
5. Highest starting salaries were reported by medical doctors and educators. Highest present salaries were reported by medical doctors and lawyers.
6. Generally, those who believed their starting salaries and their increases and promotions were above average did earn higher than average salaries and promotions. Approximately three-fourths of the graduates believed they received salary increases and promotions equal to or better than other men in their work regardless of the type of education.
7. Parents and college faculty were major contributors to the guidance these men had in choosing their vocational areas.
8. Fraternity participation and officership were the extracurricular activities which the alumni felt contributed most in preparing them for their work.

9. Those who graduated in the upper quarter of their classes favored major studies in the natural sciences. Those in the lower quarter of their classes favored the social sciences.

10. Foreign language was the least accepted course area the alumni enrolled in. In the light of their experiences since graduation work in philosophy, speech, and English literature were selected as those subjects which might be taken if they were to repeat their college training.

11. Almost nine-tenths of the graduates would return to a liberal arts curriculum if they were to repeat their college. Slightly less would return to DePauw University.

12. Willingness to learn and ability to learn were the two major expectations the alumni believed business and industry held for liberal arts graduates.

13. Major adjustments the alumni had to make during their first year of work were personal, including marriage and family, and the routine of work.

14. More men would like to use their undergraduate placement service now than used them before graduation. Placement appeared to be gaining in use and popularity.

232 pages. $3.00. Mic 57-110

STUDENT AND FAMILY ATTITUDES TOWARD FINANCING THE COLLEGE EXPERIENCE

(Publication No. 19,647)

Paul Milton Sherwood, Ph.D.
University of Pittsburgh, 1956

The basic assumption of this thesis is that students and their families should do all in their power to make it possible for the student to devote his full time during the academic year to the total college experience. The problem of the thesis is to test the extent to which students and their families accept the assumption.

In order to test acceptance of the assumption, a sample of students was chosen from the Schools of Engineering and Mines at the University of Pittsburgh. The limitations on the sample were: full-time undergraduate males, age 17 through 22, unmarried, nonveterans, living with their families and commuting to school. This sample was divided into 72 students who were working 20 hours per week or more and 54 who were not working.

All of the students completed a financial survey which indicated their estimates of actual and minimum possible expenditures for the current school year and their sources of income to meet those expenditures. After completing the survey, they were interviewed personally. Following an interview schedule, the interviewer asked for information concerning their families—educational background, sources of income, home and auto ownership, history of supporting other children in college, nature of neighborhood, and vacations. Students were asked about their history of employment, activities participation in high school and college, nature and value of present work, willingness to borrow money, and ability of parents to give them more support than they are currently receiving.

The students interviewed were rated on a five-point scale by the writer. The families of the students were rated on the same scale. As a check on these ratings, 34 of the 126 were rated individually by three competent judges using summaries of the information collected by the writer from the financial survey, and the interview.

The scale used was as follows:

Rating 1. Behavior shows a disposition to make material sacrifices in acceptance and support of the assumption.

Rating 2. Behavior shows thorough acceptance and support without material sacrifice.

Rating 3. Behavior shows some acceptance and support of the assumption.

Rating 4. Behavior shows recognition of the assumption but an absolute minimum of support.

Rating 5. Behavior shows no recognition or support of the assumption.

Based on the sample rated by the judges, the mean ratings of the sample were as follows: working students 3.00, nonworking students 1.86; families of working students 2.55, families of nonworking students 1.71. The writer's mean ratings of the 126 students were: working students 3.38, nonworking students 1.61; families of working students 3.00, families of nonworking students 1.70.

The meaning of these data is simply that nonworking students and their families are considerably more prone to accept the assumption that the college experience is a full-time job than are the working students and their families. Inasmuch as the two groups were found to be approximately equal in their socio-economic status, it is apparent that many students who carry on gainful employment during the academic year do so not because of economic need but because they think of college as only a part-time job.

The findings of this study challenge colleges and universities to take more aggressive steps to acquaint students and their families with the values to be derived from college in both its curricular and extracurricular aspects.

96 pages. $1.50. Mic 57-111

MATURITY OF EDUCATION AS A PROFESSION

(Publication No. 19,908)

Richard Avery Smith, Ed.D.
Stanford University, 1956

1. Statement of Purpose:

The purpose of this study is to determine the comparative maturity of education as a profession, to draw inferences about the problems facing education in the light of its level of maturity, and to recommend possible means of solving some of these problems as a way to attain greater maturity.

2. Procedure:

A basic postulate for the study is that the degree of professional maturity is indicated by the acceptance of professional responsibilities on the part of members of the profession, individually and collectively. Acceptance is defined as reaction to, not merely awareness of, the existence of professional responsibilities. Reaction is evident in the actions of professional workers and organizations.

Reaction is also evident in the written and spoken words of professional and nonprofessional observers and critics. The professional maturity of education is compared with that of three other professions: law, medicine, and engineering.

Survey and historical methods are employed to analyze statements and reports found in publications of professional and general interest.

Scales are designed to rate the acceptance by each profession of its responsibility in each of several areas. The significant steps of the scales are defined by descriptive statements which portray different operational levels of maturity. The steps are cumulative so that each one may be considered to include the operations described for the steps below it.

3. Findings:

The findings of this study show that education as a profession has several definite areas of maturity and immaturity. It is more mature than the other three professions in its acceptance of responsibility for recruiting candidates for the profession and for concern about the working conditions of its members. Education is less mature than two or three of the other professions in accepting responsibility for adopting and enforcing a code of ethics, for selecting candidates for admission to professional schools, for accrediting professional schools, and for licensing professional practitioners. The maturity of education as a profession is not clearly different from the other three professions in acceptance of responsibility for research and education in professional procedures, for indoctrination of its members, and for the maintenance of professional organization.

4. Conclusions and Implications:

Consideration of the actions of the other professions in the acceptance of responsibilities in which education is immature indicates that strong unified national programs are needed to attain maturity. Such programs require an integrated or highly coordinated group of professional organizations, the competent participation by the members of the profession, and the delegation of specific duties to members or groups of members who are especially qualified to provide leadership in meeting each responsibility. These requirements in turn necessitate development of programs for integrating professional organizations, educating members of the profession for competency in participation, and the development or identification of qualified leaders. 307 pages. $3.95. Mic 57-112

CONTENT GENERALIZATIONS FOR USE IN CURRICULUM DEVELOPMENT IN THE VISUAL ARTS

(Publication No. 19,910)

James Searle Storey, Ed.D.
Stanford University, 1956

The purpose of this investigation was to formulate a list of content generalizations in the visual arts which, following selection and classification, would serve as a useful guide to curriculum development in college and university art programs. The several current curricular trends that characterize the art programs have developed into patterns that are playing a significant role in higher education. Content materials of value to a wide range of possible uses affords one means by which various curriculum workers might deal with problems stemming from expansion and development.

Procedure

The conduct of the investigation involved the following four steps:

1. Selection of a Bibliography To insure that the sources of information would provide both the quality and quantity of statements for analysis, five experts, prominent in the field of art and art education, were asked to select a list of sources they believed suitable for this investigation. Forty-four books were selected and all were included in the study as a basis for an extensive analysis.

2. Collection of the Generalizations The following criteria were used to determine whether or not a statement from the sources of information would or would not be included:

> It must be a statement which expresses a relationship or an implied relationship between two or more concepts.
>
> It must be a statement in which one of the concepts refers specifically to tools, processes, or materials, the expression or utility, or to the design in the visual arts.
>
> It must be a statement that can be objectively defined.
>
> It must be a statement other than a definition.
>
> It must be a statement that is not limited by reference to specific names, places, or time.

An analysis of the recommended books provided approximately 2500 statements. These were identified and recorded.

3. Classification A logical organization with a high degree of flexibility was chosen to structure the presentation of the generalizations. A cross-reference was developed between the various areas of the visual arts and in terms of tools, processes and materials, expression or utility, and design. Each of the cross-references was further subdivided to accommodate the conditioning factors found in the generalizations. An index based on the concepts within the generalizations was added as a further step in making the organization more flexible.

4. Synthesis of the Data A synthesis of the statements was made to eliminate duplication and to reduce overlapping. The synthesis continued until discrete statements characterized the generalizations. The 964 generalizations were then classified according to the organizational structure.

Summary

Some of the values of the study may be summarized as follows:

1. The study presents a listing of generally applicable interrelated concepts as one measure of the scope of content of the visual arts.

2. The generalizations present in definable terms a relatively high order of content separated from the more factual and detailed information.

3. The presentation of the generalizations are in a sufficiently flexible organization so that the headings, cross-references and index facilitate a variety of uses of the material.

4. The listing may serve as a guide for (a) a more objective means for selection and organization of course content in the visual arts, (b) developing correlations within the visual arts or aiding in the development of interrelationships to other disciplines, (c) adjusting points of emphasis or neglect in the selection and organization of materials for a particular use in the art program, (d) providing an outline of content for those faculty seeking to expand their knowledge of the field, and (e) developing a practical instrument for use in methods courses, in-service training programs, and as an aid to writers in the area of the visual arts. 226 pages. $2.95. Mic 57-113

THE VALIDITY OF FORCED-CHOICE PERFORMANCE RATING OF AIR FORCE INSTRUCTORS AS SHOWN BY RELATIONSHIP TO STUDENT ACHIEVEMENT

(Publication No. 17,202)

Curtis Lemuel Trainer, Ed.D.
Washington University, 1956

Chairman: Adolph Unruh

Purpose

The purpose of this study was to determine the validity of Air Force forced-choice rating of instructors.

Scope

The relationship between forced-choice rating and student achievement was studied in the Ground and Airborne Radio Mechanics schools located at Scott Air Force Base, Illinois. The population studied consisted of 77 instructors and 2,243 student cases. Since the Ground Radio Mechanics school consisted of four and the Airborne Radio Mechanics school of five distinct phases of instruction, nine sets of data were collected.

Methodology

The validity of forced-choice rating was determined from correlation coefficients between instructor scores on the forced-choice form and student achievement. These correlation coefficients were obtained by the method of part correlation. Student achievement was measured by means of comprehensive pre- and post tests. The reliability of these tests ranged from .77 to .87, as determined by the parallel forms method. A face validity study of the tests was made by test experts to determine how well the tests measured the subject matter the instructor was directed to teach.

Classes were equated on the basis of student aptitude indices. The Socio-economic status of students was a constant because of the Air Force environment. Subject matter content and instructor facilities were constants because of the nature of the schools concerned.

Summary of Findings

1. The obtained part-correlation coefficients indicated there was no relationship between instructor forced-choice rating and student achievement (coefficients ranged from -.20 to .00). Therefore, with student achievement as the criterion, forced-choice rating was shown to be an invalid measure of instructor effectiveness. Since all the obtained coefficients were negative except one, which was zero, there was an indication that the forced-choice form measured something other than instructor effectiveness.

2. The relationship between instructor rank order ratings, as assigned by supervisors, and student achievement was also studied by means of part correlation. The obtained coefficients ranged from -.19 to .13. One positive coefficient and three negative coefficients were significant. None were sufficiently large to be considered of value as predictors of student achievement. Therefore, instructor rank order rating was shown to be an invalid measure of instructor effectiveness.

3. The relationship between instructor rank order rating and forced-choice rating was found to be inconsistent (coefficients ranged from -.49 to .54). Three positive and three negative coefficients were statistically significant. This indicated that a validity study based on coefficients obtained by correlating instructor rank order rating with forced-choice rating would be unreliable.

4. In this study, student aptitude indices were utilized to equate classes. Correlating these student aptitude indices with student achievement yielded coefficients that ranged from .30 to .48, with an average of .46. All coefficients were statistically significant well beyond the .01 level of confidence. This study therefore further substantiated the value of aptitude indices as a means of selecting students for training in technical schools.

116 pages. $1.50. Mic 57-114

EDUCATION, ADMINISTRATION

AN EVALUATION OF THE PROGRAM OF BOISE JUNIOR COLLEGE BY ITS GRADUATES

(Publication No. 17,501)

Acel Handy Chatburn, Ed.D.
State College of Washington, 1956

This study attempts to ascertain the extent to which Boise Junior College has met the needs of its students in the past and to show implications for improved instructional, curricular, guidance, and administrative procedures at the College. The experiences and opinions of graduates during the first 21 years' existence of the College (1934 to 1954, inclusive), as recorded on questionnaires, were used to provide most of the data; other data were obtained from the official records of the College and from faculty and administrative personnel who had been with the institution since its founding. Addresses were located for 1,395 of the 1,543 living graduates. Representing a 72.3 per cent response, 1,009 alumni returned questionnaires. There was a fairly high percentage of response from all classes, from both men and women, and from all geographical areas in which graduates were residing at the time of the survey. In no case did the response fall below 64 per cent.

Seventy-three per cent of the respondents had continued their education at some other college or university following graduation from Boise Junior College, with 72 per cent of those going on completing the baccalaureate or higher degree, indicating that the College had given transfer

students a good academic background for further study. Ninety-five per cent of these students reported that they experienced no difficulty transferring to another college; being out-of-state students was the major reason given by those who did have some difficulty. Less than 7 per cent reported that they lost any credits in transferring; in the main, those who did lose credits had earned more than 64 semester hours at Boise Junior College, in which case they were given only junior standing at the college to which they transferred.

Eighty-nine per cent of the respondents who accepted employment immediately following graduation from Boise Junior College reported that they had been prepared adequately for their respective jobs. Of the remaining 11 per cent, the majority went into a line of work which was unrelated to the kind of training they took at the College.

Respondents were reasonably well satisfied with curricular offerings and the quality of instruction at Boise Junior College but indicated that more attention should be given to areas of instruction which, in the main, could be classified under the general heading of personality development, consumer problems, human relationships, and marriage preparation. Among courses of strictly an academic nature, respondents felt that effective speech instruction should receive more emphasis. They also felt that students should be given a better background in recognizing and discharging their citizenship responsibilities as well as a better knowledge of world affairs and foreign policy. There was a strong indication that more emphasis should be given religious and ethical training. Dissatisfaction with courses centered around a few subjects, with the highest incidence during the years following World War II when the College was overcrowded with returning veterans. The incidence of dissatisfaction with courses during the last two years of the survey, namely 1953 and 1954, was very low.

By far the most frequently mentioned improvement suggested for the College by respondents was expansion to a four-year school, with 73 per cent recommending such a change. Approximately 50 per cent of the respondents indicated that guidance services should be expanded and strengthened, particularly in course programming and vocational choice. Other suggested improvements, with respective percentage of graduates recommending them, included the development of an alumni association (38 per cent), more curricular offerings (35 per cent), a larger library (32 per cent), and more scholarships for worthy students (19 per cent).

Of the 954 graduates responding to the question, "Would you recommend Boise Junior College to a friend or relative who is planning to attend college?" 96.3 per cent replied in the affirmative.

228 pages. $2.95. Mic 57-115

THE DEVELOPMENT OF TYPES OF PUBLIC SCHOOL BUSINESS ORGANIZATION, PERSONNEL IN CHARGE, AND STANDING COMMITTEES USED FOR THE MANAGEMENT OF BUSINESS AFFAIRS AS REVEALED IN SCHOOL SURVEYS

(Publication No. 19,618)

John Gordon Cober, Ed.D.
University of Pittsburgh, 1956

This study was undertaken to determine the development of types of organizations, personnel in charge, and standing committees used in the management of business affairs of school districts as revealed through the study of school surveys from 1912 to 1955.

The normative survey method of research was used in this study. A total of 129 school surveys were selected as the primary data sources. The surveys were divided into four periods to indicate trends that might develop. The periods were 1912-1920, 1921-1929, 1930-1939, and 1940-1955.

The unit type of organization changed from being the type of organization less frequently used to the type of organization most frequently used. In the first period, the unit type was used in 15.8 per cent, the dual type 52.6 per cent, and the multiple type 31.6 per cent of the 38 surveys. In the fourth period, the unit type was used in 72.4 per cent, dual 10.4 per cent, and multiple 17.2 per cent of the 29 school surveys.

Survey directors began recommending the use of the unit type of organization in the first survey studied in 1912. A few survey directors recommended the dual type of organization during the first and second periods; this changed until during the last period all survey directors were recommending the unit type or organization.

The first period was commonly one of direct management of business affairs by school boards through standing committee chairmen, board clerks, school board secretaries, or purchasing agents. The direct management of business affairs by school boards showed a gradual development to an indirect management through a business manager, assistant superintendent of schools in charge of business affairs, superintendent of buildings, superintendent of supplies, or the superintendent of schools. In the pre-dominant number of unit type of organizations during the last period, the business executive served under the direct supervision of the superintendent of schools. In the few dual and multiple types of organizations, the business manager reported directly to the school board and operated as an independent department from the educational department. The management of business affairs changed from being thought of as a separate department only interested in business affairs to one that operated to make the educational program of the school more effective.

The use of standing committees by school boards showed an increase from the first to the last period. In the first period, 57.8 per cent of the districts were using standing committees. This increased to 71.5 per cent in the second period, dropped to 60 per cent in the third period, and increased to 65.5 per cent in the last period. The total number of committees used with different titles increased from 60 during the first period to 93 during the second period. The total number dropped to 43 and 42 during the last two periods. The median number of committees used by each school board was 5, 4, 5, and 3,

respectively. The most frequently used committees in all periods were building and finance committees. Building committees were used most in all periods except the third period when finance committees appeared most frequently.

188 pages. $2.45. Mic 57-116

A STUDY OF THE CHANGES IN EDUCATIONAL OPPORTUNITIES PROVIDED FOR SECONDARY SCHOOL STUDENTS BY JOINT SCHOOL SYSTEMS OF PENNSYLVANIA

(Publication No. 19,619)

John Vincen Connoley, Ph.D.
University of Pittsburgh, 1956

The purpose of this study is to determine the changes in the educational opportunities provided for secondary students by selected joint school systems of Pennsylvania since jointure was effected.

The problem as developed has the following elements:

1. To determine the educational opportunities provided for secondary students of component districts of selected joint school systems previous to the effecting of jointure.
2. To determine the educational opportunities currently provided for secondary students of selected joint school systems.
3. To compare the educational opportunities provided and identify the changes which have emerged since the transition.

Eighty-seven joint school systems which provided a secondary school program and which began operation in the school year 1952-1953 were selected for study.

Data, in relation to six selected factors which authorities agree influence the educational opportunity provided by secondary schools, were collected directly from Secondary School Classification Reports filed with the Department of Public Instruction by the secondary schools included in the study.

The schools were divided into 11 groups, according to enrollment, to facilitate comparison. Every effort was made to compare the offerings of schools which served the youth of the same communities before and after jointure. The range, frequency, rank order, median, and per cent of change were statistical aids employed in analyzing the data.

Findings:

1. The greatest decrease in number of secondary schools occurred in schools enrolling less than 300 students.
2. Schools enrolling 300 or more students represented 49.7 per cent of the total number of schools before jointure as compared with 78.8 per cent after jointure.
3. The median enrollment changed from 201.88 to 419.5 students after jointure.
4. Schools providing secondary education for grades seven and eight increased from 68 per cent to 75 per cent of the total number.
5. All classifications except the 9-12 and the unique type of grade organization showed an increase in per cent in relation to the total number of schools.
6. There was a general increase in course offerings.
7. The per cent of increase in course offerings was higher for schools which enrolled less than 300 students before jointure.
8. Academic courses ranked high in frequency of offering before and after jointure.
9. Employment of trained library personnel increased after jointure.
10. Schools meeting minimum standards regarding number of books, library organization, and library instruction showed an increase, but many were still substandard after jointure.
11. Expenditures for library purposes did not increase in proportion to enrollment of schools.
12. Achievement and intelligence testing increased significantly. Special aptitude, interest, and personality areas increased in use, but in a lesser degree.
13. Median class size increased from 25.8 to 27.4.
14. Median teacher-pupil ratio based on actual teaching personnel increased from 1:20 to 1:21.2.
15. Median class load of teachers increased from 24.6 to 26.6 classes per week.

Conclusions:

1. Joint operation of schools provides a framework which stimulates the provision of secondary education for grades seven and eight.
2. Joint operations did not change the philosophy of secondary schools concerning the importance of academic subjects.
3. There is no apparent relationship between size of school and teacher load except for small schools which enroll less than 100 students.
4. Expenditures for library purposes are of the "lump sum" variety and have not kept pace with increased enrollment of schools.
5. It is apparent that students of small secondary schools (less than 300 enrollment) benefit more from joint operation than do students of larger schools.

196 pages. .$2.55. Mic 57-117

PROBLEMS RELATED TO THE FORMATION AND OPERATION OF REORGANIZED SCHOOL DISTRICTS IN PENNSYLVANIA

(Publication No. 18,093)

I. Newton Cowan, Ed.D.
Temple University, 1956

NEED, PURPOSES, AND METHOD

Need For the Study

School district reorganization has proceeded at an accelerated pace in Pennsylvania since 1947 because of constantly increasing school enrollments, increasing construction costs, favorable legislation, and the public recognition of the need for more effective administrative units. The problems involved in this reorganization are many and complex. Identification of them, determination of how and why they arose, and suggestions and recommendations regarding their solution, should prove of value.

Purposes

The purposes of the study were:

1. To define the major problems in forming and operating joint systems and union (including merged) school districts in Pennsylvania.
2. To assist school districts in recognizing and defining the problems.
3. To identify factors relevant to a solution of these problems.
4. To make suggestions regarding the type and scope of school district reorganization.
5. To make recommendations concerning the methods of achieving desirable school district reorganization.

Method

A stratified sample of 20 joint school systems and 10 union school districts was selected. Interviews in depth were conducted with the administrators of these reorganized units. The articles of agreement of the 20 joint systems were also studied. From these data certain findings, conclusions, and recommendations were derived.

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The following findings, conclusions, and recommendations represent the writer's judgment of the major results of the study. Many others may be important.

Findings

The major findings of this study are:

1. The most pervasive problems of reorganization were:
   (a) educating the public to the need for and the values of reorganization;
   (b) the location of buildings;
   (c) providing sufficient financial resources;
   (d) suspicion and mistrust;
   (e) proper planning at the state level.
2. Public understanding was considerably better and fewer problems resulted where an effective public relations program was in operation during the time of planning reorganization.
3. Those administrative units with a pupil population of 1600 or more were more likely to possess an adequate financial base for education, and encountered fewer operational problems than those with fewer than 1600 pupils.
4. Those reorganized units which conformed with socio-logical boundaries faced fewer problems and added more services after reorganization than those which did not conform.
5. Union districts were no more difficult to achieve and were beset with fewer operational problems than jointures.
6. The chief problems of operation were related to inadequacy of the financial base for education, to increased costs of capital outlay and debt service, and to increased transportation of pupils.
7. Equalization of assessments by a state agency may be necessary in order to alleviate the problems of local financial support, especially those aggravated by crossing political boundaries.
8. Administrators felt that many additional educational services were still needed in their reorganized districts, but that state aid was inadequate to provide them.

Conclusions

The major conclusions drawn from the findings of this study are:

1. Reorganized school districts should conform with socio-logical community boundaries.
2. A planned public relations program involving lay personnel is necessary to reduction of the problems related to reorganization of school districts.
3. A pupil population of 1600 or more is desirable in the reorganized district.
4. A better method of distribution of State reimbursements is necessary to insure the establishment of a minimum program of education.
5. Equalization of assessments, preferably by State action, and additional State reimbursement are necessary to provide sufficient financial resources.
6. Proper planning at the State level, more dynamic leadership, and an effective intermediate unit are needed to promote proper reorganization.
7. It was a mistake to encourage the formation of joint school systems in Pennsylvania.

Recommendations

The major recommendations are:

1. The administrative unit be so organized as to strengthen existing community relationships.
2. A planned public relations program employing lay personnel be a part of the State and local reorganization programs.
3. The recommended minimum pupil population of 1600 be more carefully considered.
4. Legislation be enacted for equalization of assessments by a state agency.
5. State aid to local school districts be on the basis of a foundation program.
6. The supplemental reimbursement for union school districts be substantially increased.
7. The formation of new jointures be discontinued.
8. The State reimburse local districts for the entire cost of pupil transportation.
9. A State plan of reorganization be developed by a lay committee with professional assistance.
10. Sufficient State field representatives be available to plan and coordinate local reorganization.
11. A State-supported intermediate unit be established.

632 pages. $8.00. Mic 57-118

EXTENDED USE OF SCHOOL PLANT FACILITIES

(Publication No. 19,620)

Marcus William Davies, Ed.D.
University of Pittsburgh, 1956

The purpose of this study was to determine the use made of public school buildings and grounds for nonschool purposes in school districts of Allegheny County, Pennsylvania, during the 1954-1955 school year, and to sample attitudes and opinions concerning such use as expressed in these school districts.

The elements of the study are: (a) existing statutory provisions in Pennsylvania affecting the nonschool use of

public school buildings and grounds as they have been interpreted in the state courts, (b) the nature and scope of use of public school buildings and grounds during nonschool hours, (c) current administrative practices regarding the regulation of nonschool use of public school property, (d) financial factors related to operational costs and rental charges involved in the nonschool use of public school buildings and grounds, and (e) opinions related to nonschool use of local school district property. The normative survey method of research was used in this study.

The following are the principal findings of the study: Pennsylvania statutes encourage the use of public school property in the state for nonschool purposes with court decisions upholding the discretionary power lodged in the school board to determine the nature of the nonschool use of school property.

Student groups, school-connected groups, cultural and character building groups, civic groups, educational groups, teacher and other school employee groups, community social and service groups, and local, county, state, and federal agencies were generally permitted the nonschool use of school district facilities by all districts.

Funds raised from admissions charged by groups using public school property were almost exclusively used for expenditures benefiting school buildings, students, or some worthy community purpose.

School board rules and regulations governing nonschool use of local school property favored the following areas of control: (1) required supervision, (2) maintenance order and good conduct, (3) care and proper use of all facilities, (4) limitations on hours of use, (5) limitations on smoking, (6) prohibition on use of alcoholic drinks, (7) observance of all rules and regulations, (8) the assignment of responsibility, and (9) right of board to revoke or alter terms of use.

Permission and rental charges for nonschool use of local school property are governed by: facilities requested, time of use, hours of use, residence, sponsorship, type of activity, purpose of group, purpose of use, and use of proceeds resulting from such use.

Most school districts charge rental fees to meet costs of nonschool use of school property. Less than half the school districts pay additional compensation to assigned personnel to supervise nonschool use of school property.

Opposition of certain groups to nonschool use of public school property is founded on low pay of personnel, additional labor involved, and competition with business. The majority of school administrators recommend improvement of school building facilities, better parking, and limited smoking during use, as factors which would encourage increased nonschool use of school property.

The study concludes that: (1) the state courts consistently uphold the discretionary power of school boards to determine the use of school property for nonschool purposes, (2) present school district budgets will continue to emphasize costs over extended use of school property, (3) school boards regard the educating of young people as its primary function, (4) school boards rely on the good judgment of nonschool groups to select sponsored activities which uphold aims and ideals of public schools, (5) school districts should make provisions for increased nonschool use of school property since they serve the whole public, (6) increased school population, a broader concept of education, and an awakened community interest in using school property during nonschool hours will serve to focus attention of school officials on the problem of increasing collateral use of public school facilities.

194 pages. $2.55. Mic 57-119

THE SOCIAL COMPOSITION OF AND ATTITUDES TOWARD EDUCATIONAL PLANNING OF COUNTY BOARDS OF EDUCATION IN WEST VIRGINIA

(Publication No. 19,622)

Harold Eugene Eaton, Ed.D.
University of Pittsburgh, 1956

The determination of the social composition and attitudes toward educational planning of county boards of education in West Virginia was undertaken with three objectives in mind. The first of these was to determine the social composition of the county board of education member in the state of West Virginia. It was hoped that by determining the age, sex, marital status, church preference, and other social composition factors of the board members, it would be possible to ascertain any influence exerted by these factors on their educational attitudes. In order to accomplish this, it was necessary, as a second objective, to determine the attitudes of county board of education members toward selected issues in educational planning. Finally, the last objective was to determine the relationship of social composition factors to the attitudes of county board members toward selected issues in educational planning.

The normative-survey was the primary method used in the study. To carry out this method a questionnaire was developed and validated through the use of external criteria, i.e., authoritative literature in the field of education administration. The questionnaire was submitted to all individuals concerned and upon its return, statistical and tabular analysis of the obtained data was made.

Through the use of the obtained data, a narrative and tabular description was made of the social composition of the West Virginia board member, as well as his attitudes toward issues in educational planning. Selected social composition factors were compared with a derived attitude score in an effort to determine any relationship between the factors and the attitudes of the board members toward educational planning.

It was found that the average West Virginia board member is a man about 50 years of age. He is married and has children. As a child he lived in a rural area and received his early schooling in a one-room school. He is a high school graduate and has had the advantage of some type of higher education. As a home owner, he is interested in his community where he attends church and belongs to at least two organizations and a political party. He engages in hobbies, has traveled rather extensively, and is well read.

School board members in West Virginia are aware of and interested in the problems of public school education. The statements used to determine board members' attitudes could best be answered by indicating agreement with the statement. In every case, more than half of the members surveyed indicated approval of the statements as presented, and often the percentage of agreement was much higher.

An effort was made to determine any possible influence of social composition factors on the attitudes exhibited by board members. In each of the seven areas compared, no clearly defined relationship was indicated though slight trends were discernible. Perhaps this in itself is encouraging, for we can say that no special social or socio-economic group is proving productive of outstanding board members. If this is true, and it seems that it is, we can also infer that a community cross section, from the standpoint of individuals serving on the board, will give us our best opportunity to serve our youth educationally. The social composition of the West Virginia boards of education indicated that the state is being served by this community cross section of individuals. This alone may be sufficient for hope and belief that the job will be well done. The West Virginia board member is interested in the schools of the state; he has informed himself educationally in diverse ways, and will probably upgrade the position in years to come. 161 pages. $2.15. Mic 57-120

INSTRUCTIONAL SERVICES RENDERED BY COUNTY SCHOOL OFFICES IN MICHIGAN AND RELATED FACTORS: AVAILABLE PERSONNEL, NUMBER OF TEACHERS AND PUPILS SERVED, EXPENDITURES PER PUPIL SERVED, AND AVAILABLE EQUIPMENT AND MATERIALS

(Publication No. 18,600)

Edward John Ernatt, Ed.D.
University of Michigan, 1956

This study determines the nature and extent of instructional services provided school districts in the State of Michigan by the county school offices. The number of available resource personnel, the number of teachers and pupils served, the per pupil cost of instructional services, and the instructional equipment and materials made available by county school offices to enrich the school programs, particularly in the rural school districts, were used as measures of service.

The chief source of data was a twenty-five page questionnaire. This questionnaire was developed in cooperation with six county school superintendents who checked each item for clarity, comprehensiveness, and availability of information. Two copies of the questionnaire were mailed to all eighty-three county school superintendents. Sixty-three of the superintendents completed and returned this instrument.

The questionnaire was further validated by cross-checking key items and by examining county school office records and reports at the State Department of Public Instruction.

Some major conclusions drawn on the basis of this study are as follows:

1. Early legal provisions stipulated specific duties for county school superintendents in connection with improvement of the instructional programs in the school districts within the county. Through the years, however, the role of the county school superintendents in Michigan has changed from an emphasis on instructional improvement services to emphasis on general administrative and business and finance services.

2. Of the forty instructional services studied, the greatest attention was given to supervision of elementary education in school districts which look to the county school office for services. In the larger counties employing helping teachers, supervision of instruction was almost exclusively the responsibility of these specialists.

3. Activities such as coordination of elementary and secondary education, planning new programs and services, developing research and pilot projects, and evaluating instruction in the rural schools were limited to a few county school offices.

4. Forty-one of the sixty-three respondents indicated a need for a State Department of Public Instruction consultant to work with the county school superintendents. Assistance in developing new instructional programs, aid to new county school superintendents with difficult problems, help with fiscal and child accounting matters, advice on legal questions, and assistance in coordinating and evaluating county school programs were the most frequently mentioned services which this consultant could provide.

5. Services for exceptional children provided directly by the county school offices were limited to a few counties. Six counties provided speech correction services for the smaller districts within the counties. Approximately one-third of the respondents indicated that they used personnel and facilities available from other agencies. Child guidance clinics, the Michigan School for the Blind, the Michigan School for the Deaf, and various city-school districts providing such services as homebound teachers, services for epileptic children, and services for the mentally retarded were cited.

6. Health improvement services, such as hearing and vision screening, environmental sanitation service, dental health programs, and school nurse service were provided largely by the county health departments.

7. Audio-visual equipment and materials to enrich the instructional programs in the smaller school districts were available from the county school offices in fewer than half of the responding counties.

8. Curricular improvement publications of some significance, such as courses of study, bibliographies, educational monographs, and resource units, were not fully utilized in the improvement of teaching and learning in the smaller school districts. Fewer than one-third of the respondents have provided publications of this character within the last three years.

238 pages. $3.10. Mic 57-121

SCHOOL BUDGETING AND FINANCIAL ACCOUNTING IN SMALL INDEPENDENT SCHOOL DISTRICTS OF OKLAHOMA

(Publication No. 19,490)

Arthur Farrar, Ed.D.
The University of Oklahoma, 1956

Major Professor: Gerald A. Porter

This study constitutes an effort to facilitate improvement in budgeting and accounting procedures in small independent school systems in Oklahoma. Its primary

purpose was to effect major improvements in the school budget instrument used in Oklahoma. Because of the interdependence of the budgeting and accounting functions of school administration, it was also necessary to develop an adequate accounting system designed to provide essential data quickly and accurately for the budget and financial reports.

The major steps involved in this study included: (1) the identification of desirable practices and procedures in budgeting and accounting for school systems, (2) identification of the legal requirements relating to public school budgeting and financial accounting in Oklahoma, (3) designing of a school budget instrument to permit the application of sound principles of budgeting, and (4) devising of account classifications and ledger forms to relate directly to the budget instrument and existing financial reporting requirements.

The recommended school district budget was developed with special emphasis on the presentation of the proposed educational program of a school district. It was designed to encourage educational planning and the development of school board policies to activate the proposed plans. In addition, the budget form provides adequately for presenting data needed to substantiate appropriation requests and for certifying the approved appropriations. The budget instrument and accounting forms developed in this study contain uniform standard classifications of accounts and were designed to emphasize simplicity and saving of time.

Conclusions reached on the basis of the evidence in this study are:

1. A body of established sound principles basic to proper development of adequate school budgets and financial accounting systems currently exists. To accomplish the most effective school administration, the individuals directly concerned should at all times adhere to these basic principles.

2. There remains little if any doubt that the most significant element in the school budgeting procedure is the development of an appropriately stated educational program to provide the basis for actual preparation of the financial aspects of a school budget. Although this is an often neglected phase of the total budget procedure, it is absolutely essential to achievement of the maximum effectiveness of financial management in a school district.

3. To facilitate proper school administration, the accounting system must consist of a sound standard classification of accounts used in conjunction with simple to understand and compact ledger accounts and report forms.

4. The school budget and accounting forms designed for and recommended in this research report, if used in small independent school districts throughout Oklahoma, would facilitate almost immediate improvements in the utilization of school funds. The ultimate result would be more effective instruction in the individual classrooms.

216 pages. $2.80. Mic 57-122

A CRITICAL EVALUATION OF STUDENT COUNCIL PROGRAMS IN SELECTED PUBLIC HIGH SCHOOLS OF CONNECTICUT BASED UPON REACTIONS OF PRINCIPALS

(Publication No. 18,324)

William Thomas Fisher, Ph.D.
The University of Connecticut, 1956

Statement of the Problem.

This study concerned itself with an evaluation of student councils in selected public secondary schools in Connecticut. The State Department of Education of Connecticut lent its support to this study, the first of its kind in the State.

Procedure.

Questionnaires, covering basic philosophy, activities, internal and external structure, and evaluation, were sent to 80 secondary school principals throughout the state, with 66 or 82.5 per cent responding. Results were studied in three groups, small (1-399), medium (400-799), and large (800 students and over) for the purpose of detecting similarities and differences.

Results.

The data indicate that the student councils in Connecticut do not place undue emphasis upon high scholastic achievement as a prerequisite to holding council office, do demand a satisfactory citizenship record, do not emphasize a satisfactory attendance record, do not believe that the council is primarily instituted as a regulatory or restrictive body, have little faith in the student court idea, believe that representation should be on an equitable base, prefer the unicameral form of legislature, leave the selection of the sponsor to the principal, and for the most part operate under a written constitution.

The study disclosed that in the opinion of the majority of the participating secondary school principals, activities with positive appeals, such as planning assembly programs and courtesy committee work, were more educationally sound than activities with negative appeals, such as student courts and student participation in discipline.

The student council was found to be weakest in aiding the development of such experiences as reaffirming faith in American Freedoms and increasing respect for academic standards and high marks. The council was judged to be doing its best work in helping students to develop the techniques of leadership and in bringing about an understanding of the methods of democratic procedures.

The study revealed the strain upon student councils to raise money. The largest drawing account for small schools was found to be for athletics; for medium and large schools, assembly programs, with a separate organization handling athletic expenses. The confused, varied and reluctant financial picture of councils within the State prompts the suggestion that boards of education should consider partial financial support of the activities program, thereby freeing student councils from some of their time consuming and educationally questionable money raising activities.

The Connecticut Federation of Student Councils was found to be an effective means for unifying and solidifying student councils in the State. Two major suggestions for improved services came from the study: (1) state and

regional meetings should be arranged on basis of school interest and enrollment, and (2) there should be more publicity and better dissemination of news on the local level concerning the activities, functions, internal structure and plans of the Connecticut Federation of Student Councils.

Conclusions.

It was concluded that student councils in Connecticut high schools are attempting to operate in a democratic way, affording the "average pupil" an opportunity to develop his potentialities. The trend in student council activity is away from emphasis upon complicated form, machinery of operation, and concern with problems of school discipline toward a broad social purpose which causes student councils to be more and more concerned with the contribution councils can make toward the education of youth. In this connection evidence supports the assertion that evaluation of student council activity is seen as an important facet of educational leadership; that financing activities sponsored by student councils needs more study and more professional leadership and; that student councils are more and more concerned with problems designed to promote understanding of social and educational issues.

399 pages. $5.10. Mic 57-123

A STUDY OF THE HISTORY AND STATUS OF DISTRICT BOARDS OF SCHOOL TRUSTEES IN THE COUNTY SYSTEMS OF MARYLAND

(Publication No. 17,804)

Jacob Earl Hershman, Ed.D.
University of Maryland, 1956

Supervisor: Dean Henry Brechbill

The organization of Maryland's educational system includes administrative boards at three levels: the state board of education heading the state structure; the county board of education administering the county system; and the board of district school trustees representing the local community. This study is concerned with one phase of the system--namely, district boards of school trustees.

History reveals that the relationships between county boards of education and local boards of district school trustees have been rather contentious on occasions throughout the educational development of Maryland. This lack of rapport, which was usually due to repetition or confliction of function and legal vagueness, led to the dissolution of district boards in twelve of Maryland's twenty-three counties.

The purpose of this survey was to determine through contacts with a representative sample of the various levels of school personnel and school patrons who had had experience in working with or as school trustees, along with a careful survey of the available literature, whether or not boards of school trustees, as they now exist in Maryland, do or could serve any worthwhile purpose.

The questionnaire and interview techniques were used to collect the major portion of the data used in the study. The survey itself involved 1220 participants. A total of 987 school administrators and patrons from Maryland including county school superintendents, boards of education members, school trustees, elementary school principals, parent-teacher association presidents, and patrons, submitted data for the study. Two hundred and thirty-three county superintendents from the states of Alabama, Georgia, New Mexico, and Florida furnished data that were used for comparative purposes.

In organization, the first part of the study deals with the historical evolution of education in Maryland and the role played by school trustees in this development. The second part examines the opinions regarding the past and present status of school trustees in Maryland as submitted by school persons who had had experience in working with or as school trustees.

These opinions of various school persons, along with other pertinent evidence obtained from the available literature, suggested some very definite conclusions. The major conclusions include the following: (1) Varied opinion exists among Maryland educators as to the actual legal status of school trustees; (2) There is a need for more closely established relationships between county boards of education and school trustees in the various counties of Maryland; (3) There appears to be a need in Maryland for school trustees to function in a liaison--public relations capacity with both specific and advisory responsibilities; (4) A significant number of Maryland school administrators feel that school trustees should be elected to office.

General recommendations growing out of the data as interpreted by the investigator are to the effect that the administrative structure of Maryland's educational system would be strengthened if the following changes were instituted: (1) Legislation establishing district boards of school trustees in Maryland should be mandatory; (2) School trustees should be given both specific and advisory powers; their primary responsibilities should center in the area of liaison--public relations; (3) School trustees in Maryland should be elected by the patrons of the school district; (4) Boards of school trustees should file regular reports of their activity with the county board of education.

507 pages. $6.45. Mic 57-124

FACTORS CONTRIBUTING TO THE PROBLEM OF TEACHERS IN THE SECONDARY SCHOOLS OF MARYLAND LEAVING THE PROFESSION FROM 1950 TO 1955

(Publication No. 19,632)

Wayne Walter Hill, Ph.D.
University of Pittsburgh, 1956

This was a study of factors contributing to the problem of teachers in the secondary schools of Maryland leaving the profession from 1950 to 1955. The general method used was the descriptive-survey. The data were obtained by means of a questionnaire submitted to 506 former teachers, selected at random, who left their positions in the white secondary schools of the 23 county school systems of Maryland for reasons that indicated that they were withdrawing permanently from teaching. The questionnaire was designed to learn from each respondent all of the principal and underlying reasons for his leaving the profession, the adjustments that would be necessary to encourage his return to teaching, or that would have caused

him to remain if they had been made while he was still employed, and certain personal and professional characteristics to be used in analyzing the withdrawal problem.

The structure of the participating group was determined according to the personal and professional data reported by the 427 teachers who returned completed questionnaires. Personal characteristics included were: (a) age; (b) marital status; (c) sex; (d) dependency status; and (e) present occupation. Professional characteristics were: (a) years of college training; (b) type of teacher training institution attended; (c) subject field; (d) degrees held; (e) certificates held; (f) date of last college attendance; (g) years of teaching experience; (h) years in last teaching position; (i) size of last school; and (j) salary in last teaching position.

An analysis of general factors in teacher withdrawals was made to find the ratio of avoidable losses to unavoidable losses and determine the relative effects of five classes of reasons - economic, professional, personal, community, and other - as principal and contributing factors in teacher resignations from the profession. This was followed by a detailed analysis of each class of reasons and their effects on teacher withdrawals. Retention and return factors in each classification were also discussed. Each analysis was made in terms of selected personal and professional characteristics of the respondents.

The results indicate that the per cent of teachers in the secondary schools of Maryland who left the profession from 1950 to 1955 was higher than the national average, that more than half of the losses were avoidable, and that most of the adjustments suggested by the respondents as steps that would favor retention or return of teachers are within the powers of the local educational leaders. The majority of the respondents left for multiple reasons, rather than a single reason, with the underlying causes of withdrawal being important, as well as the principal causes. Their responses to factors favoring retention or return showed that many of them were still interested in teaching.

There were definite relationships between certain personal and professional characteristics and the tendency to leave the profession. Strong positive connections were found between tendency to withdraw and: (a) youth; (b) marriage by women; (c) first year of teaching; (d) one year in last position; and (e) low salary.

The respondents placed personal and professional reasons for withdrawal ahead of economic reasons. Marriage, pregnancy, and full-time home making duties were responsible for most of the losses for personal reasons. Professional reasons that led to withdrawals by many teachers were working conditions that were less favorable than those of other professions, lack of helpful supervision, discipline problems, and the attitudes of parents and pupils toward scholarship.

This study shows that failure to keep pace with other professions in matters involving working conditions, salaries, and rewards for effort and growth has caused many teachers to leave the profession. It indicates that the solution to the withdrawal problem is possible only if home, school, and community accept, without reservations, their complete roles in making teaching a rewarding profession.

327 pages. $4.20. Mic 57-125

A STUDY OF THE COMMON FACTORS INFLUENCING THE APPROVAL OF PROJECT APPLICATIONS FOR AUTHORITY FINANCING IN PENNSYLVANIA

(Publication No. 19,634)

Samuel Woods Jacobs, Ed.D.
University of Pittsburgh, 1956

The public schools of the nation in 1955 were ill prepared for the tremendous upsurge of pupil enrollment then underway, and, according to all known predictions, likely to continue at least through 1970. School building facilities were very inadequate. In Pennsylvania a survey revealed that 40 per cent of the Commonwealth's public school buildings were more than fifty years old and less than four per cent have been built after 1940. School districts sought a satisfactory method of providing the funds necessary for new buildings. A new financial device called an "Authority" had been employed successfully in recent years in other phases of public works. An Authority, a separate corporate entity which acquires or constructs a public project and finances same by issue of its own bonds, was first utilized in Pennsylvania in 1933 to provide for construction of public works other than schools. This Authority Plan was modified and, by 1951, State Public School Building Authority and Municipal School Building Authority legislation was enacted. The constitutionality of this legislation was repeatedly challenged; however, the Pennsylvania Supreme Court, in a series of decisions, upheld the legality of all such legislation.

This study was made to analyze certain factors involved in the approval or rejection by the Department of Public Instruction of applications for Aurhority financing. Based chiefly upon the documentary-frequency type, the normative-survey method of research was followed. All approved applications filed by the Department were surveyed. These numbered 833 in December, 1954. In order to obtain the most comparable data, only approved applications, or "lease-approvals", for new elementary schools were selected for analysis. There were 165 such lease-approvals in this group; 60 were under the State School Building Authority Plan and 105 under the Municipal School Building Authority Plan. From this broad sampling of approved applications, data were tabulated for these 11 factors common to most applications:

1. Class of School District
2. Wealth of School District
3. Geographical Location of District
4. Adequacy of School Site
5. Unit Cost Per Pupil
6. Unit Cost Per Classroom
7. Unit Cost Per Square Foot
8. Unit Cost Per Cubic Foot
9. Anticipated Enrollment in District
10. Per Cent of Financing Requested
11. Number of Classrooms Requested

By compiling and interpreting sets of tables and charts regarding the above factors, certain significant facts became apparent: (1) all nine areas of the state have some lease-approvals but they were not distributed equitably upon the basis of population; (2) in almost complete contrast to the school site situation in 1951, more than three-fourths of the new buildings constructed under the Authority financing were located on adequate sites; and (3) the

majority of the applications approved were from districts which had low inherent wealth, yet anticipated marked increases in pupil enrollment. Relative to unit cost measures, no definite patterns evolved. The median costs of $1052 per pupil, $30,000 per classroom, $14.84 per square foot, and $1.02 per cubic foot were not indicative of marked central tendencies in any of these unit measures. The range between the highest and lowest unit cost in each factor was more than 4::1.

It was recommended that the Department of Public Instruction: (1) establish a basic measure of unit cost, equitable for all districts, to insure durable construction; (2) administer the Authority financing program to encourage the establishment of large attendance units; and (3) encourage financially impoverished districts to seek Authority financing in order more nearly to equalize educational facilities.

The Authority plan of financing has furnished a legal method to provide school buildings needed in many school districts otherwise unable to obtain them. This plan has been of inestimable value in the improvement of the public school plant facilities in Pennsylvania.

180 pages. $2.35. Mic 57-126

URBAN COMMUNITY MATURATION AND SCHOOL PLANT PLANNING

(Publication No. 19,905)

Samuel Burchell Kermoian, Ed.D.
Stanford University, 1956

Statement of the Problem

The purpose of this study is to determine the relationship of selected characteristics of community maturation to school-age population and to indicate the implications of patterns of community maturation for school plant planning.

Procedure

San Francisco, California was chosen for study. Various ecological factors as components of variables which affect a community's internal spatial pattern were selected from census tracts. These include: (1) age of population, (2) housing characteristics, (3) ethnic composition, (4) mobility, (5) income.

The city's over-all growth was traced, its thirteen communities studied individually, and school enrollments plotted.

School-age population was correlated with the remaining ecological factors. Next, age of dwellings was selected as a criteria of community maturation. Each of the thirteen communities were ranked in relation to the proportion of dwellings constructed during four periods. These four rankings were then individually correlated with the remaining ecological factors. Spearman's rho formula was used. A significance level of .05 was adopted.

The city's over-all growth was traced, its thirteen communities studied individually, and school enrollments plotted.

Results

School enrollments were found to rise and fall in cycles. Similarity was discovered in the initial enrollment cycles of two communities which differed as to type of dwellings but which developed within the period of available data and early enough for study. In the case of these two communities, it was possible to generalize enrollment periods from the cycles which developed.

Variables which affected enrollment cycles were noted and their effects analyzed.

Correlation results indicated the existence of significant relationships between school-age population and the age of dwellings and their relationships to other population and dwellings characteristics. Stages in community maturation were generalized. These were found to bear a potential relationship to the enrollment cycle.

Conclusions

Communities containing large proportions of new, one or two unit, owner-occupied dwellings also contain, on the whole, a large proportion of school-age children and a small proportion of aged persons.

Communities mature in stages, each bearing a potential relationship to periods in an enrollment cycle. Community maturation stages and parallel enrollment periods are described. These include: (1) Construction of Dwellings Stage--Period of Ascension, (2) Stage of Population Stability--Period of Retrogression, (3) Stage of Variable Change--Period of Fluctuation, (4) Invasion Stage--Period of Declination.

Subsequent enrollment cycles do not repeat in a set pattern. Cycles rise and fall in response to many interrelated variables which act upon the community including: (1) changes in birth rates, (2) type and composition of the invasion groups, (3) time and amount of new construction, (4) changes in size and age aggregate of the population, (5) economic conditions, (6) redevelopment.

A thorough study of enrollment and maturation trends on a community basis should be an important part of any investigation of school plant needs. There should be a continuous re-evaluation of school plant needs. School sites should be large enough to handle possible future as well as present building needs. A need for some portable or demountable classrooms is indicated to provide the flexibility needed to handle temporary enrollment swells. A comprehensive policy of plant maintenance, rehabilitation, abandonment, and replacement is necessary.

The pattern for enrollment changes in San Francisco is indicated, and the predicted course of enrollments given for each community.

229 pages. $3.00. Mic 57-127

THE DEVELOPMENT OF THE LEGAL STRUCTURE AND THE PROGRAM OF PUBLIC HIGH SCHOOL EDUCATION IN OKLAHOMA

(Publication No. 19,494)

Clay Witten Kerr, Ed.D.
The University of Oklahoma, 1956

Major Professor: D. Ross Pugmire

Literature relating to the history of education in Oklahoma is concerned with specific professional areas or is limited to definite periods of time. No research has been completed which includes all high schools and the entire time covered by the history of the State.

The record of the high school movement begins with the establishment of academies by the Five Civilized Tribes in Indian Territory about the middle of the nineteenth century. High schools were organized in Oklahoma Territory soon after passage of the Organic Act.

Development of public high schools in Oklahoma has been influenced by the limitations inherent in the school district, a legal municipality designed to serve the education efforts to reorganize the school district resulted in the establishment of several hundred high schools, many of which are small in geographical area served and low in enrollment. A factor which has affected the situation has been the migration of farm population to the urban centers. This shift in population has caused the abandonment of hundreds of small non-high schools and materially changed the high school program in the State.

Significant revisions in the high school curriculum have been made from time to time since the first high schools came into being. Originally a college preparatory institution, the high school has modified its courses of study by changing emphasis from academic to vocational and occupational types of instruction. In recent years, the Junior High School has become an important part of the total school program, thereby providing for a more satisfactory transition of the student from the elementary grades to the high school.

Improvement in the teaching personnel represents a phase of public high school development which is of unusual interest and value. For the first few years of the educational history of the State the teachers usually were professionally untrained. In recent years this condition has changed to such extent that improved standards of professional preparation have been attained which make the technical training of the teachers of Oklahoma relatively high among the states of the Nation.

A program of accreditation of high schools has achieved unity in standards which have been conducive to marked improvement in the quality of instruction. All high schools in Oklahoma now are accredited by the State Board of Education and more than one hundred of these also are members of the North Central Association of Secondary Schools and Colleges.

A great deterrent to effective development of the high schools in this State has been that of inadequate financial support. The legal framework of the public school system originally was designed to provide for local revenues in each school district sufficient to support all public schools therein. Local taxation, however, has yielded insufficient funds, and the State has found it necessary to supplement district revenues with appropriations from the State Treasury. Expansion of the high school movement and the existence of an unexpectedly large number of small high schools has made this need more acute than might otherwise have been the case. 244 pages. $3.15. Mic 57-128

A STUDY OF SCHOOL BOARD IN-SERVICE TRAINING TECHNIQUES

(Publication No. 19,275)

Harley M. Lautenschlager, Ed.D.
Indiana University, 1956

Problem: The purpose of this study was to find out from school board members the techniques to help them better understand the characteristics of a modern school program and its operation that they had used since becoming school board members, and to discover the relative effectiveness to board members of each of the techniques.

Procedure: The interview technique was used to gather data from 45 school board members selected by the executive secretaries of state and regional school board associations in Indiana, Illinois, and Michigan. An interview guide was used which considered the following educational aspects of school board work: (a) understanding the characteristics of a modern school program; (b) securing information about their own schools; (c) keeping in touch with the community; (d) developing and retaining competent school staffs; and (e) evaluating the work of their own schools. The data were classified and described under these five headings.

Findings and Conclusions: The findings indicated that school board members are conscientious in their efforts to perform well the functions of school board membership. Board members depended heavily on their superintendents for information, guidance, and leadership. Board members felt that Parent-Teacher groups rendered valuable assistance to school boards. Enthusiasm was expressed by board members for the stimulation, guidance, and information received through state and national associations of school boards. Regularly scheduled, well-organized local school board meetings with an agenda and supplementary materials mailed to board members at least three days prior to board meetings were extremely helpful to board members. Published reading materials did not play a very important role in helping school board members with the educational program aspects of their work.

Lay advisory groups, when welcomed and accepted by the school boards and the superintendents, had rendered valuable assistance to school boards. Visiting schools outside of their own districts had been helpful to board members. School board meetings were seldom attended by lay citizens except when motivated by dissatisfaction.

Board members indicated that industry recognized the position of school board membership to be one of considerable prestige, and hence one of considerable public relations value. Having a superintendent and principals with whom teachers liked to work, providing teachers with adequate equipment and instructional supplies, and establishing a warm, friendly atmosphere in the schools were regarded by board members as being of greater significance than salaries in retaining competent teachers. In evaluating

the work of their schools, board members indicated that they used surveys of a part or all of their educational program by outside and local groups, reports by the superintendent and other staff members about the standardized testing programs and other phases of their schools, and the degree of active participation of their professional staffs in outside professional groups.

116 pages. $1.50. Mic 57-129

THE STATUS, DUTIES, AND RESPONSIBILITIES OF THE ASSISTANT PRINCIPAL IN THE HIGH SCHOOLS OF OKLAHOMA

(Publication No. 19,495)

Bill Lillard, Ed.D.
The University of Oklahoma, 1956

Major Professor: Dr. F. A. Balyeat

The growth and development of larger and more complex high schools in Oklahoma has placed an increased burden on the principals of these institutions. More are requiring the services of administrative assistants to fulfill their duties and responsibilities. The delegation of responsibility has created the position of assistant principal.

The purpose of the study was to ascertain the status, duties, and responsibilities of the assistant principal in the high schools of Oklahoma.

The data were collected by the use of a questionnaire constructed for the study and a personal interview. The data represent a response of one hundred per cent of the assistant principals employed in the high schools of Oklahoma during 1955-1956.

The assistant principal was most often employed in a high school utilizing the three year administrative plan. He was male, married, forty-six years of age, and received an annual salary of $4,957. The median enrollment of the high schools was 981 with a certificated staff of forty-three. Over ninety per cent held the master's degree and three-fourths of that group had school administration as a major field. The professional experience most often included high school teaching. The selection procedure included an interview with the principal. The position was utilized more frequently by the larger cities of the state. The assistant principal was more active in professional than civic and fraternal organizations.

The duties and responsibilities for the position were prescribed orally by the principal in four-fifths of the cases. The majority of the duties and responsibilities were shared by the assistant principal with other persons. He assumed his most important role in the area of attendance and discipline. The one responsibility personally assumed by a majority was acting as principal when he was not on duty. A major role was assumed by the assistant principal in the areas of general administration and extra-class activities. Minor roles were assumed in the areas of guidance and counseling, instruction and supervision, the school plant, and public relations.

From the results of the investigation the following conclusions are offered:

(1) An assistant principal should be employed without teaching duties, in high schools with enrollments of more than seven hundred.

(2) The professional preparation for the position should be the same as for the principalship.

(3) There is need for the development of a procedure for the selection of applicants.

(4) A need exists to make the salary commensurate with the responsibilities assumed.

(5) A clearer definition of the duties and responsibilities is needed.

(6) The position may be considered as training for the principalship.

140 pages. $1.85. Mic 57-130

PRACTICES AND OPINIONS OF TEXAS SCHOOL ADMINISTRATORS CONCERNING FEDERALLY REIMBURSED VOCATIONAL EDUCATION

(Publication No. 17,907)

Homer Earl Money, Ed.D.
University of Missouri, 1956

Supervisor: Dr. H. H. London

PURPOSE OF STUDY: The purpose of this study was to ascertain practices and opinions of Texas School Administrators concerning federally reimbursed programs of vocational agriculture, trade and industrial education, distributive education, and vocational home economics.

METHOD OF RESEARCH: Opinionnaires were prepared and mailed to every superintendent and principal in Texas whose school offered one or more federally reimbursed vocational program. The forms contained questions concerning present practices and issues pertaining to the aforementioned vocational programs. The data were tabulated by the IBM section of the University of Missouri.

SUMMARY: There was no appreciable difference in the manner in which principals from various sizes of school responded to the questions.

A sizable number of administrators indicated that no professional education courses had aided them in administering vocational programs.

Length of vocational classes resulted in scheduling difficulties.

General education funds were being diverted to vocational education because of state and federal requirements.

State and national vocational clubs were considered desirable and encouraged.

Few schools offered vocational education courses which were not federally reimbursed.

State supervisors of vocational programs gave sufficient help to administrators and were courteous in doing so.

Separateness between vocational and general education was not noticeable in a majority of schools; federal and state legal administrative requirements had not tended to cause separateness. There were not too many state and federal controls attached to vocational programs.

Administrators were of the opinion that it was unsound practice to withhold reimbursement from classes which mixed vocational and nonvocational students.

Administrators thought their communities regarded vocational education highly, and would support vocational agriculture and home economics even if federal funds were withdrawn.

The vocational education needs of youth were not being met and there was a need to increase the number of vocational offerings.

Administrators were opposed to the use of federal funds in the employment of vocational counselors; too much emphasis was placed on professions by counselors; equal emphasis should be placed on vocational and college preparatory education.

Administrators and specialists were not in agreement on counseling procedure, items to be considered in selecting students for vocational programs, and what to emphasize in selecting trade and industrial teachers.

In the opinion of administrators, vocational teachers kept abreast of current changes in their fields.

Administrators were not in favor of vocational teachers receiving larger salaries, and they were not convinced that larger salaries were necessary for recruiting vocational teachers.

CONCLUSIONS: Colleges and universities should include history, philosophy, and organization and administration of vocational education in their training programs for school administrators.

Salaries of vocational teachers and length of vocational classes were two sources of irritation to school administrators.

School administrators were definitely at odds with the requirement precluding the use of federal funds to classes composed of vocational and nonvocational students.

The social status of students was not affected by enrolling in vocational courses.

The idea of separateness between general and vocational education seems to be diminishing in the public schools of Texas.

There is a need to increase vocational education offerings.

Administrators' opinions of what guidance should be does not correspond with authorities in the field.

Federal aid seemingly has played a major role in developing vocational education in Texas.

State and national affiliated vocational clubs have become an integral part of vocational programs.

Help given by the state vocational supervisory personnel seems to be satisfactorily meeting the present needs of administrators of local school vocational programs. 230 pages. $3.00. Mic 57-131

THE ROLE OF THE PRIVATE PHYSICIAN IN THE MEDICAL EXAMINATION AND FOLLOW-THROUGH OF SCHOOL CHILDREN IN THE CITY OF DETROIT

(Publication No. 19,065)

Arthur G. Parkllan, Ed.D.
Wayne University, 1956

Adviser: Charles L. Boye

Purpose of the study.--The purpose of the study was to survey the relationship of the private physician to the school health program in Detroit, Michigan. Because the private physician is responsible for all medical examinations of school children in Detroit, he holds a key role in the school health program. His technical knowledge determines the quality of the medical examination he gives, but his feeling of responsibility in following through a defect to correction, and his knowledge of and attitudes toward the school health services program determine how well his knowledge is put to use.

As a result of individual and joint study by representatives from the fields of education and medicine, objectives and standards for the medical examination and follow-through have been developed. To determine how well objectives and standards, set nationally, are being met in Detroit, the practices, attitudes, and knowledge of the private physician were studied as they relate to the school health program.

The study was limited to the following three areas:

1. The extent to which Detroit physicians are in agreement with the minimum school medical examination standards recommended by the Joint Committee on Health Problems of the A.M.A.-N.E.A.

2. The extent of physicians' felt responsibility in follow-through.

3. Physicians' knowledge of and attitudes toward the school health services program.

Design of the investigation.--A pretested, three-page questionnaire consisting of eighteen items was mailed to a random sample of 177 generalists and thirty-eight pediatricians. Eighty-four percent were returned within three weeks. Interviews of a random sample of nonrespondents showed that, using the chi-square test, no significant difference was revealed at the 0.05 level between nonrespondents and respondents on any of the questionnaire items.

Summary and conclusions.--The conclusions are presented as they relate to the three major areas of the study. Considered first is the extent to which Detroit physicians are in agreement with minimum school medical examination standards.

Detroit generalists agree with the recommendations of the joint committee concerning the contents of the medical examination and the time usually spent in giving an examination. They disagreed concerning the grades at which the examination should be given and the frequency of examination. A large percentage of both groups recommended annual examination, a concept generally rejected by school health authorities.

Concerning the extent of physicians' felt responsibility in follow-through, the data clearly indicate that generalists

have standards different from pediatricians. Among generalists current accepted practices in follow-through are not widespread, while pediatricians almost unanimously subscribe to them. Detroit generalists and pediatricians both show unresolved differences in their interpretation of their responsibility in follow-through, which indicates that a difference may also exist in the vigor with which follow-through procedures are pursued.

Concerning physicians' knowledge of and attitudes toward the school health services program, pediatricians show a significantly greater awareness than do generalists. Neither group shows familiarity with the special education program. Both groups feel screening tests to be a function of the school but feel teachers lack the training to conduct screening properly. Both groups express, almost unanimously, a need for a description of the function of the school health services program.

The data indicate that generalists and pediatricians in Detroit are technically well qualified but lack contact with the objectives and services of the school health program. Since generalists give nearly 88 percent of the medical examinations to school children and show themselves to be not as well informed concerning the school health program as pediatricians, the conclusions of the study have special significance for them.

158 pages. $2.10. Mic 57-132

THE RELATIVE EFFECTIVENESS OF THE QUALITY OF TRANSPORTATION OF CONTRACT AND DISTRICT-OWNED PUPIL TRANSPORTATION SYSTEMS IN PENNSYLVANIA

(Publication No. 19,641)

Vernon Charles Patterson, Ed.D.
University of Pittsburgh, 1956

This is a study to determine the relative effectiveness of contract and district-owned transportation systems in Pennsylvania by an examination of the following measures: (1) Regularity of Service, (2) Convenience, (3) Comfort, (4) Security, (5) Conveyance, (6) Operating Personnel, (7) Administration, (8) Extra Merits, and (9) Costs.

There are 1,430 districts in Pennsylvania which employ the contract method of pupil transportation while 182 districts have district-owned equipment exclusively.

For comparative purposes, 50 representative district-owned systems of pupil transportation in Pennsylvania were matched with 50 contract systems by using the following criteria: (1) Number of Vehicles Operated In District, (2) Number of Pupils Transported, and (3) Morning Route Mileage. These 50 matched districts were compared by using the "Pupil Transportation Score Card," developed by Virgil Ruegsegger. Information was gathered through the questionnaire method. Records of the Department of Public Instruction, Harrisburg, Pennsylvania, were also a valuable source of information.

Statistical procedures for calculating the significance of the difference between two sample uncorrelated means were used to check the reliability of the difference between the two means. Significance at the 95 per cent level of probability was considered satisfactory.

The test of superiority of one type of pupil transportation over another method of transportation was contingent upon a series of null hypotheses which were tested in the study. The results indicate that we may confidently reject the hypothesis that there is no difference in the quality of transportation between district-owned and contract systems. Several of the general conclusions determined in the analysis of responses included:

1. District-owned systems of pupil transportation in Pennsylvania are superior to the contract systems in the quality of pupil transportation when considering all of the measures.
2. The district-owned systems operate more modern transportation equipment than the contract systems.
3. The most significant difference between district-owned systems and contract systems was in the section on "Conveyance," with the district-owned systems having the advantage.
4. The district-owned systems had a marked advantage in the section, "Personality Traits of Drivers."

The general conclusion is that the district-owned systems are more effective than the contract systems in the quality of pupil transportation in Pennsylvania.

159 pages. $2.10. Mic 57-133

THE DEVELOPMENT OF EXTENSION RECREATION IN PENNSYLVANIA WITH SPECIAL EMPHASIS ON THE PERIOD FROM 1948 TO 1953

(Publication No. 19,644)

James Amos Reed, Ed.D.
University of Pittsburgh, 1956

The purpose of this study was that of describing the development of recreation as a part of the extension education program in Pennsylvania. The factors were presented which resulted in the development of educational responsibility for recreation in the Commonwealth.

Data included in this study were gathered from direct sources as well as documentary ones. Direct sources were used in gathering data concerning the main part of the study; some documentary ones were consulted in the development of the background material.

The direct sources of data which were used included: (a) state laws of Pennsylvania, (b) personal interviews, (c) original reports, and (d) a questionnaire.

Two methods of research were employed to gather and record the data: (a) the historical method in connection with the background material and legal aspects of the problem, and (b) the descriptive-survey method in treating the development of recreation as part of the extension education program in Pennsylvania.

The findings and conclusions of this study were summarized as follows:

(a) Recreation has become an integral part of the public education program in Pennsylvania.

(b) Since recreational activities were not a compulsory part of the education program, these varied greatly among the communities and were mainly governed by local environmental influences such as: (1) community desire to promote and support recreation, (2) leadership within the

school district, and (3) size and wealth of the school district.

(c) Recreation programs have steadily increased in number and broadened in scope since 1948. However, many programs were unbalanced by: (1) overemphasis on a few activities, (2) activities not being scheduled on a year-round basis, and (3) most activities being arranged for persons under 18 years of age.

(d) School staff personnel were predominantly relied upon to direct recreation programs and conduct individual activities. These persons volunteered for this service and were usually compensated by separate salary in addition to that earned for teaching.

(e) Lack of adequate training and teacher certification standards created many personnel problems which limited leisure time activities in numerous school districts, indicating a need for the establishment of definite standards in recreation education comparable to those in other special fields of education.

(f) Continued state financial support is necessary to the success of recreation in Pennsylvania since most districts are otherwise unable to support adequate programs. This support should be extended to adult leisure time activities through proper legislation.

(g) There is need for the establishment of a state interagency committee to further coordinate the governmental efforts and responsibilities of all agencies concerned with recreation at all levels of administration.

(h) There is need for an extensive program of research in recreation education to promote future orderly progress designed to meet the growing leisure-time needs of all persons. 208 pages. $2.65. Mic 57-134

PUPIL TRANSPORTATION IN SANTA CLARA COUNTY PUBLIC SCHOOLS

(Publication No. 19,907)

Norman Harris Sarratt, Ed.D.
Stanford University, 1956

It was the purpose of this study to analyze present pupil transportation in Santa Clara County public schools and to investigate possibilities for centralizing facilities and services for more efficient and economical operation. An attempt was made to answer the following questions:

1. What is the function of a pupil transportation program and what place does it have in the educational structure?
2. When is a pupil transportation system efficient, economical and desirable?
3. What are current pupil transportation practices in Santa Clara County?
4. What, if any, combination or centralization of existing pupil transportation facilities and services are feasible in Santa Clara County?
   a. A combination of services of existing elementary districts?
   b. A combination of services within existing high school districts?
   c. Regional or other combinations suggested by the analysis?
   d. Centralized purchasing?
   e. Contracting for transportation services?

A questionnaire by Isenberg entitled Guide for Analyzing a Pupil Transportation Program was revised to meet California requirements and used for evaluating pupil transportation in 38 school districts. An exhaustive cost analysis was also made.

Findings of the study led to the following generalizations:

1. Organization of pupil transportation at the state level of administration in California was found to be adequate. Organization at the level of operation in Santa Clara County was found to be inadequate.
2. Generally speaking, administrative units at the district level in Santa Clara County were found to be inadequate in policy formation, safety education, purchasing, routing, record keeping, public relations, driver selection and training, and school bus maintenance. Buses were found to be adequate.
3. Administrative units at the district level were not of sufficient size to justify the employment of transportation experts, centralized purchasing and adequate maintenance of equipment.
4. Unit costs in pupil transportation were analyzed and found to be unreliable for making comparisons between systems.
5. A combination of transportation facilities in Santa Clara County elementary school district would provide a fleet of buses large enough to realize the advantages of large-scale operation and would be desirable.
6. A combination of transportation services and facilities within existing high school districts would result in bus fleets too small to be efficiently and economically administered and operated.
7. A centralized purchasing system in Santa Clara County would be desirable.
8. Although ownership and control of school buses below state level would be most desirably located in a county administration or other intermediate type unit larger than a local district, there is, at present, no provision for such an administration. However, a more desirable centralization could be realized, possibly, at this time by the addition of Coordinator of Pupil Transportation Services to the staff of the County Superintendent of Schools. It would be possible under such an arrangement to provide the county with the specialized and technical knowledge essential to efficient organization and operation of large-scale pupil transportation program. The possibility also exists under this arrangement for providing school districts with centralized shop services necessary for efficient maintenance; a system of centralized purchasing; and an opportunity to initiate the reorganization necessary to provide a centralized county-wide unit of administration.

266 pages. $3.45. Mic 57-135

A PROPOSED AUDIO-VISUAL PROGRAM FOR THE UNIVERSITY OF THE PHILIPPINES

(Publication No. 19,284)

Tomas P. Tadena, Ed.D.
Indiana University, 1956

The Problem

This study proposes an audio-visual program for the University of the Philippines and presents alternative approaches toward its attainment, based on successful audio-visual practices and their underlying principles as indicated by literature and research and adapted to suit local conditions in the Philippines.

Procedure

Audio-visual programs reported in literature and research studies were analyzed. Generally accepted successful practices were gathered and the principles underlying them drawn out. These practices and principles were synthesized and adapted to conditions obtaining in the Philippines in general and in the University of the Philippines in particular. Then a proposed audio-visual program for the University of the Philippines was outlined and reasons for proposing such a program were given. Alternate approaches were presented as ways of implementing the proposed audio-visual program.

Findings

The audio-visual program in a university is generally organized under the Extension Division or in the School of Education. All activities are centralized in one department under one head.

The audio-visual program receives an annual allotment from the university budget supplemented by income from rental and service fees and the sale of university-produced films and filmstrips. Insufficient funds is the most frequently reported deterrent to the rapid growth of audio-visual programs. A revolving fund system of financing some services of the audio-visual program, like the film library and motion picture production, have been found successful.

The size of the staff of an audio-visual center is determined by the extent of its services. The minimum staff for even a small program consists of a director, one clerk-stenographer, and one technician. The director is identified with the faculty and given academic rank. Students are generally employed as assistants and helpers.

The professional education function of the audio-visual program is generally emphasized, which includes both preservice and in-service training of teachers. Materials service and production are also important functions of the program.

Some factors that could affect an audio-visual program in the University of the Philippines are the following: (a) highly centralized organization, administration, and financing of the public schools; (b) lack of locally produced educational films and filmstrips; (c) lack of personnel with special preparation in audio-visual education; and (d) inadequate budget for the University of the Philippines and the public schools.

Conclusions

1. The administrative location of the audio-visual center in the College of Education of the University of the Philippines is in line with general practices in American universities.
2. The present personnel, materials, equipment, and facilities of the audio-visual center are fairly adequate for starting an audio-visual program in the University of the Philippines.
3. There is a need for audio-visual specialists to teach in normal schools, teachers colleges, and education departments in universities in the Philippines.
4. The National Media Production Center and the Bureau of Public Schools have audio-visual facilities which could be profitably utilized by the University of the Philippines.

Recommendations

1. The University of the Philippines should have an integrated audio-visual program with teacher education, campus and off-campus materials service, and production.
2. The emphasis in teacher education should be on the graduate level in order to meet the demand for instructors of audio-visual courses in normal schools, teachers Colleges and education departments of universities.
3. The University of the Philippines should arrange with the National Media Production Center to have the latter's audio-visual facilities available to its advanced audio-visual students.
4. The University of the Philippines should consider the 10-year teacher education, materials service, and financing plan proposed in this study.

265 pages. $3.45. Mic 57-136

A STUDY OF THE PASTOR'S HOSPITAL MINISTRY

(Publication No. 18,364)

William Graydon Tanner, Ed.D.
University of Houston, 1956

I. Introduction

Today, care of the hospital sick is one of the major considerations of the minister. It is his duty, by reason of his calling, to maintain an active hospital visitation program. The object of this program is to relieve his members of the physical, mental, emotional and spiritual anxieties and sufferings associated with the illness experience during hospital confinement. This study has been made in order to determine what factors constitute a successful hospital ministry. Emphasis has been placed particularly upon the patient's reaction to the pastor's hospital visit, which actually forms the basis for the whole hospital ministry.

II. The Purposes of the Study

1. To suggest constructive improvements for the pastor's hospital visits by means of data collected from questionnaires both to patients and ministers, and from a review of literature.

2. To determine by means of collected data how pastors may be helpful as a working component of the hospital team.

3. To discuss and suggest how the hospital visit would be varied with special groups of sick, including children, surgical, maternity, convalescent, and invalid patients, and those facing death.

4. To present for deliberation a resume of unfavorable impressions concerning the minister's hospital visit as suggested by the patients questioned.

III. Collection and Treatment of Data

Data were secured by three means: (1) questionnaires, (2) interviews, and (3) a review of literature. One of the questionnaires developed was used as an instrument to present the reactions of the hospital patient to the minister's visit. On the basis of authoritative opinions and research, such a questionnaire with this particular objective had not been presented before. This questionnaire, which was distributed to two hundred and fifteen hospital patients, was divided into three sections: (1) the statement questions, (2) the "yes" and "no" questions, and (3) the personal data sheets.

The investigator used a second questionnaire consisting of eight questions. These were distributed to ministers attending the Houston Ministerial Alliance in February, 1956.

Both groups of the completed questionnaires and the personal data sheets were summarized, their findings were then incorporated into this study. The interviews were included in a review of the literature, and also the summarization of the study. An intensive review of literature, in this and related areas, was included in this study.

IV. Summary and Conclusions

The investigator has classified his conclusions in the final chapter under the four purposes of the study. There are seventy-three suggestions and observations in this chapter. For purposes of this abstract the investigator has included one pertinent conclusion representative of each of the four purposes of study.

1. The minister should continually strive to gain a more complete knowledge of counselling resources and ways to employ them effectively in a ministry of healing.

2. Forty-three ministers questioned in Houston, Texas, spent an average of thirty per cent of their professional time visiting hospitalized members. Ninety per cent stated they felt that the hospital ministry was very important. However, eighty-one per cent felt their working relationship with the hospital team could be improved. The effectiveness of the pastor's hospital ministry is greatly dependent upon his ability to cooperate with other professional people in the hospital.

3. The investigator suggests that the hospital counselling interview should be varied with special groups of sick, including: children, surgical, maternity, convalescent and invalid patients, and those facing death.

4. One of the most pertinent criticisms of the pastor's hospital visit was that he was not sincere in his approach to the patient. Thirty-eight per cent of the patients questioned stated that they gained no spiritual help from his visit. Thirty-five per cent of those questioned felt that the pastor's prayer was not personal to their needs.

307 pages. $3.95. Mic 57-137

EDUCATION, ADULT

DEVELOPMENT OF CRITERIA FOR THE EVALUATION OF LOCAL PROGRAMS OF TRADE AND INDUSTRIAL EDUCATION

(Publication No. 19,285)

Glade Wilcox, Ed.D.
Indiana University, 1956

The purpose of this study was to provide criteria appropriate for use by teachers, administrators, supervisors, and laymen, as well as students of education in the evaluation of local programs of trade and industrial education. It was intended to set up standards which could be used in the qualitative evaluation of existing programs of trade and industrial education.

The initial data for this study were selected from literature containing authoritative statements of labor, management, and education concerning positions taken with reference to vocational-industrial education. From a population of more than two thousand statements of position, 632 distinctive statements were developed. The criteria were then developed by placing the distinctive statements in groups of like concept and phrasing each of the resulting 60 concepts as a positive statement. The 60 criteria were validated by a jury composed of the 51 chief supervisors of trade and industrial education from each of the states and territories with vocational-industrial education. The responses from the experts were then statistically treated to determine the significant criteria by the standard error of proportion. The level of significance was taken at three standard deviations and the acceptable criteria were grouped into three arbitrary importance groups.

Conclusions

From the findings of this investigation based on the criteria that were developed in it, the following major conclusions were drawn:

1. At least 96 per cent of the judges used some discretion in validating the criteria.

2. Fifty-six of the 60 criteria that were developed were found to be significant. Of these 56 acceptable criteria 41 were within a one standard deviation significance level on an arbitrary scale, and 52 were acceptable at two sigmas.

3. Rating scales that are currently in use contain statements of value which aided in determining criteria not acceptable to the judges. This discrepancy would seem to indicate that the rating scales included irrelevant items in as much as a point-to-point editing of the investigator's work by the director of the thesis was used as a measure of control over conveying an incorrect concept.

4. Several of the older tenets of vocational education rated below what might have been expected. These include: (a) the curriculum is fitted to the students' needs, (b) the shop environment is a near replica of the one in which the student will subsequently work, and (c) the program is based on satisfying the local need for less-than-college grade industrial training.

5. Less significant conclusions which may reasonably be made from the results of this study include: (a) experienced vocational-industrial supervisors, acting as judges, apparently have difficulty in relating general statements of classification to all of the various specific elements making up the classification, (b) because of the

limitation of sematics, there should be carefully detailed definitions and explanations or examples given with criteria and rating scales.

Recommendations

After the conclusions had been drawn the following recommendations became apparent:

1. These criteria are particularly adaptable to the evaluation of current rating scales.
2. The criteria may be used as guides to organization and practices that must be included to make a local program both acceptable and functional.
3. Teachers, administrators, supervisors, and students of vocational-industrial education may use the criteria as indices of completeness in evaluating local programs.
4. Interest in this study has indicated that the criteria should be further developed by determining the extent to which each of the significant statements is found or followed in subsidized schools.

248 pages. $3.20. Mic 57-138

EDUCATION, HISTORY

THE INFLUENCE OF THE ALBERTA TEACHERS' ASSOCIATION ON EDUCATIONAL LEGISLATION IN ALBERTA, 1918-1948

(Publication No. 19,896)

Warren Stevenson Bailey, Ed.D.
Stanford University, 1956

Problem

This study outlines the history of organized teachers in Alberta as it relates to events leading to the enactment of educational legislation. The information thus obtained is examined to determine the influence that the teachers have been able to exert in securing the enactment of these statutes.

The study is limited in time to the first thirty years of the A. T. A. and in scope to the field of provincial legislation.

Method

The first step in developing the problem was the selection of the major objectives of the A. T. A. which could be achieved by legislative action. These were chosen primarily from policy statements appearing in the minutes of the general meetings and executive meetings of the Association. These were expanded and emphasized in the editorial pages of the A. T. A. Magazine, the official organ of the Association. The history of attempts to secure legislative action pertaining to these objectives was traced through the available sources. In addition to those just mentioned, these included the files of the daily newspapers of the province, the Statutes of Alberta, and miscellaneous documents in the A. T. A. files.

This procedure provided four major areas of investigation to each of which one chapter is devoted. These areas are:

1. Legal establishment of the profession.
2. The struggle for security of tenure.
3. Building the retirement plan.
4. Securing adequate salaries.

An additional chapter outlines the A. T. A.'s activities in six other areas in which the results were often not such as would appear in the statutes, but rather as regulations or policies of the Provincial Department of Education. This is presented to give a more complete grasp of the range of activities of the organization and includes these topics:

1. Recognition and representation on boards dealing with educational matters.
2. Professional training of teachers.
3. Certification of teachers.
4. Establishment of a Faculty of Education at the University of Alberta.
5. Larger units for school administrative purposes.
6. Government grants in aid of education.

Results

The A. T. A. was one of a complex configuration of forces interested in educational legislation during the period of the study. Analyzing the changes in school law for the period leads to certain conclusions which vary in the extent to which they are applicable. Some can be well substantiated from the information presented, while others are less well documented but strongly suspected as important factors relative to the influence of the A. T. A. on legislation during the term of the study. These do not fall into well defined categories, but range from the certain to the suspected.

Conclusions

Substantial evidence shows the following to be successful techniques.

1. A dogged tenacity, pushing a campaign for many years when necessary.
2. Unusually vigorous protestations, often used to prevent undesirable legislation.
3. Working jointly with other groups toward a common end.
4. Use of strike action as a drastic last resort.
5. Indirect means permitting the objective to be achieved in a different form.

Other factors which cannot be so clearly documented or isolated but which are strongly suspected to have influenced legislation are:

1. The vigorous leadership of John Barnett which pervaded all activities of the A. T. A.
2. The radiating influence of success in a campaign.
3. Capitalizing on a change in government.
4. The increasing stature of the A. T. A. in the educational enterprise.

204 pages. $2.65. Mic 57-139

EDUCATION, PHYSICAL

THE RELATIONSHIP BETWEEN THE MUSCULAR FITNESS OF THE WELL-ADJUSTED CHILD AND THE NON-WELL-ADJUSTED CHILD

(Publication No. 19,672)

Mary Virginia Alexander, Ph.D.
University of Michigan, 1956

The purpose of this study was to determine whether any relationship exists between minimum muscular fitness and adjustment of the children in the fourth, fifth, and sixth grades of the public schools of Leon County, Florida. The minimum muscular fitness of each child was determined by the results of the Kraus-Weber Minimum Muscular Fitness Tests. The teachers determined the extent of adjustment by the Stout and Langdon Criteria of well-adjustment. The children who were classified as well-adjusted and non-well-adjusted were used in the study. The differences between the well-adjusted and non-well-adjusted children in their performance on the minimum muscular fitness tests were studied in an effort to determine if any relationship existed between the two, and if so to what extent.

The results show that of the group of 714 boys and girls, 486 were classified as well-adjusted and 228 as non-well-adjusted. When the boys and girls were considered separately it may be noted that of the group of 387 boys, 225 (51.1 per cent) were well-adjusted and 162 (41.9 per cent) were non-well-adjusted. In the group of 327 girls, there were 261 (79.8 per cent) who were well-adjusted while 66 (20.2 per cent) were considered non-well-adjusted.

When the Chi-Square test was used the results showed that significantly more of the well-adjusted children were muscularly fit than of the non-well-adjusted group. More of the girls were well adjusted and muscularly fit. When the age and grade levels were compared the results did not indicate that muscular fitness or well-adjustment were more characteristic of one age or grade than of another. However, in the group who were muscularly unfit and non-well-adjusted the strength failures appeared to vary with age, that is, there were more strength failures in the older groups. There were fewer incidence of failure (total tests failed) in the group who were muscularly fit and well-adjusted than in the group who were muscularly unfit and non-well-adjusted.

There were three basic hypotheses postulated and the findings permit some definite conclusions concerning each.

The first hypothesis stated that of the group of children classified as well-adjusted more of them would be muscularly fit than of those classified as non-well-adjusted. Based on the results of this study this hypothesis is accepted.

The second hypothesis stated that there would be fewer incidences of failure of the muscular fitness tests in the well-adjusted group than would be found in the non-well-adjusted group. The results indicate this tendency, thus this hypothesis is accepted.

The third hypothesis stated that more of the children in the city schools, where physical education is taught by a special teacher, will both perform better on the muscular fitness tests and be better adjusted than the children in the county schools, where physical education is taught by the classroom teacher. Adjustment and fitness did not show to be more characteristic of one group than of the other. The third hypothesis was rejected.

137 pages. $1.85. Mic 57-140

SPORTS PARTICIPATION AND INTERESTS OF HIGH SCHOOL BOYS IN THE STATE OF ILLINOIS

(Publication No. 19,675)

Robert Joseph Antonacci, Ed.D.
University of Michigan, 1956

The purpose of this study was to determine the sports in which Illinois secondary school boys participate; and the sports they would like to participate in, together with the reasons why they are not participating. The students' practices and opinions were expressed on a Sports Participation and Interest Inventory. A stratified random sample involving three thousand high school students was used to obtain the data.

The required school-time and leisure-time sports participation percentages for each school year were analyzed. The students' frequency of sports participation, and the rank of the most participated in sports are shown. Student experiences in the high school physical education program were centered around the Team and Gymnastic Sports. The majority of students received little experience in Aquatic, Combative, Individual, Outing, Pastime, Rhythmic, and Winter Sports; however, a substantial number of students during their leisure time engaged in these activities.

When the students' disinterest and likes were examined, it was found that most students indicated the highest like-interest in swimming, basketball, baseball, softball, boating, and fishing. More than one-half of the respondents showed a like-interest in twenty-six activities. The least popular activities were folk dancing, fencing, apparatus, calisthenics, tumbling, and speedball.

In another section of the study, the sports students seldom participate in, but in which they would like to spend more time are analyzed. Students expressed a strong desire to learn the individual type of activities, particularly those of tennis and golf. Over one-half of the students responded that lack of facilities and/or lack of skill were factors keeping them from engaging in the activities they desired.

Students' experiences in varsity and intramural programs are presented in the last part of the study. The results indicated that these programs were concentrated around a few Team Sports.

Several general conclusions can be drawn from the study. In actual practice the school physical education program does not meet the needs and interests of youth, since (1) most of the students' sports instruction appeared in the traditional Team Sports; yet (2) students in all grades expressed a desire for Individual, Aquatic, Pastime, and Outing activities. (3) There was little consideration given to make seniors cognizant of their future leisure, or how best to utilize it. (4) Non-participants desired to learn and to participate in Individual, Aquatic, Pastime, and a few Team Sports. (5) Lack of facilities

and/or lack of skill were the main factors handicapping students or keeping them from engaging in the activities they most desired. 200 pages. $2.60. Mic 57-141

PLANNING BOYS' GYMNASIUM FACILITIES FOR SECONDARY SCHOOLS

(Publication No. 19,895)

William Benjamin Arce, Ed.D.
Stanford University, 1956

The Problem

A theory of school planning based on the development of educational specifications by personnel familiar with the educational program to be housed has been proposed in the literature. Educational specifications are based on the assumption that a facility should be designed in terms of the activities it is intended to house. This theory of planning served as the frame of reference for the study.

The two purposes of the study were (a) to determine appropriate planning procedures for secondary school boys' gymnasia, and (b) to derive current recommended practices in space needs, facility needs, and facility relationships to guide the planning of boys' gymnasiums for secondary schools.

Procedure

Four steps were used in the planning procedure for a boys' gymnasium based on the development of educational specifications.

The first step was the consideration of all activities of the curriculum conducted by the boys' physical education department and the selection of those activities which would be conducted indoors. The methodology involved the development of a careful, precise description of the indoor activities of those curricular activities which have been developed in response to the objectives of physical education. Data for these descriptions came from authoritative literature in the field and controlled observation of selected programs.

The second step was the description of the indoor activities to clarify their effect on facilities intended to house them. Each activity was described in a format which cited (a) the official activity area, (b) the number of participants, (c) the equipment necessary, (d) the nature of the activity, and, (e) the organization and administration required to conduct the activity. Facility requirements were cited at the conclusion of each activity description.

The study concerned a gymnasium to be used for school and community activities which would not inhibit the physical education curriculum conducted therein. Therefore, the third step was the identification and description of extra-curricular activities housed in gymnasia. Appropriate literature was used to identify such school and community activities. The identified activities were then described with regard to (a) the nature and scope of activity with consideration for both participants and spectators, (b) the equipment necessary, and, (c) the organization and administration required to conduct the activities with consideration for both participants and spectators. Facility requirements were cited at the conclusion of each description.

The fourth step was an interpretation of the described activities in terms of architectural factors of planning. The planning factors used were (1) accessibility, (2) beauty, (3) economy, (4) flexibility and expansibility, (5) integration, (6) isolation, (7) safety-hygiene-sanitation, (8) supervision and management, (9) utility, and, (10) validity.

Educational specifications for a boys' gymnasium in a specific situation were developed by the study. Total enrollment, maximum class size, teaching methods, administrative policies and activities to be housed in the gymnasium were assumed. The planning procedures set forth by the study were applied to these assumptions to develop educational specifications for the boys' gymnasium in this school situation.

Care was taken to insure that the educational activities described included all important activities, careful definition of terms, and precise description. This careful delineation of the antecedent demands and conditions makes possible the valid determination of consequent facility requirements.

Findings and Conclusions

The findings and conclusions of this study are distributed throughout the planning procedures involved in the development of the educational specifications. They are found in the analysis of curricular and extra-curricular activities housed in gymnasia to determine the effect of these activities on facilities intended to house them. They are also found in the form of current recommended practices in space needed, facilities needed, and facility relationships in (a) the interpretation of activities and their facility requirements in terms of architectural planning factors, and in, (b) the development of educational specifications for the assumed school situation.

372 pages. $4.75. Mic 57-142

SURVEY OF SECONDARY SCHOOL PROGRAMS OF HEALTH AND PHYSICAL EDUCATION FOR BOYS IN THE STATE OF MICHIGAN

(Publication No. 18,621)

Newton Clayton Loken, Ed.D.
University of Michigan, 1956

The purpose of the study was to evaluate the physical education programs for boys in the secondary schools of Michigan by comparison to the standards set up through the LaPorte Score Card No. II. This study was part of a nation-wide study in which each state was to be surveyed in a manner similar to that used to survey Michigan.

One hundred of the public schools accredited by the Bureau of School Services of the University of Michigan were selected on a stratified random basis with the schools divided into groups according to School Size, Town Size, and Geographical Location.

Each school was personally visited by the writer and through the use of the LaPorte Score Card, representatives of each physical education department were interviewed.

In the analysis of the total score for the physical education programs of the high schools of Michigan it was found that this state was only 37 per cent effective in terms of the ideal program depicted by the LaPorte Score Card No. II. Michigan schools had a mean score of 113 out of a possible three hundred with a range of scores from thirty-six to 188. It was found that the larger schools and towns had better total scores. The schools of Detroit and the schools of the suburbs of Detroit had higher total scores than other schools from towns and cities throughout the state.

In the analysis of the division scores it was found that the Modified Program Division had an extremely low score of .26 which indicated that this area in the physical education programs was almost non-existent. The divisions which had an effectiveness of 30 per cent were Medical Examinations and Health Service, Swimming Pool, and Program Content. The remaining divisions – Locker and Shower Areas, Outdoor Areas, Administration of Intramural and Inter-school Athletics, Supplies and Equipment, Indoor Areas, and Organization and Administration of Class Program – showed an average effectiveness of 47 per cent with a range of scores from 13.8 to 14.8 out of a possible thirty points.

In analyzing the entire state it was felt that there was a need for more effort to better coordinate the program over the five areas covered by the LaPorte Score Card, namely: dual sports, team sports, aquatics, rhythms, and gymnastics. A better testing program should be installed so that the teacher and principal could be able to determine whether or not real learning and progression were taking place. The class size should be reduced since many of the programs were operating with too many pupils in a class. The intramural programs throughout the state should be intensified. Finally there was a need for more state-wide supervision and control over the physical education programs. There was a need for state-wide policies that could be recommended to high school administrators so that the entire state might have a more standardized program of physical education.

150 pages. $2.00. Mic 57-143

AN ANALYSIS OF GRADUATE THESES IN SCHOOL SAFETY IN THE UNITED STATES FROM 1925 TO 1950

(Publication No. 19,651)

Charles Peter Yost, Ph.D.
University of Pittsburgh, 1956

This study was concerned with the identification and analysis of masters' theses and doctoral dissertations in school safety as a basis for identifying and classifying various practices, procedures, policies, and instructional information in school safety for functional use by school personnel.

An examination of theses titles in bibliographical references and in information received from leaders in the field of safety education revealed that 307 graduate theses had possible bearing upon school safety. Through interlibrary loan, 298 of these studies were obtained for purposes of analysis.

In analyzing the obtained graduate theses, attention was given to: (a) noting if each study was actually a graduate thesis or a "seminar report"; (b) noting if each study had direct bearing upon school safety; and (c) noting if each study met the research criteria developed for study purposes. Further analysis of the obtained studies involved noting various descriptive characteristics including the years and institutions when and where studies were completed, the degrees for which they were submitted, the research methods involved, the grade levels for which the studies were primarily concerned, the general topical emphasis, and the geographical areas where the studies were conducted.

Findings of the studies were analyzed and classified for functional use by school personnel by formulating various major topics and subtopics emerging from the graduate theses themselves. Major topics under which explicit procedures and policies were formulated included "The General School Safety Program," "Safety in Athletics, Physical Education, and Recreation," "Safety in School Shops," and "Traffic Safety."

Major conclusions were: (a) No single source was available for identifying graduate theses in school safety. Bibliographical listings were erroneous in some instances, and titles of graduate theses were sometimes misleading; (b) the scholarly effort in the area of school safety reached its peak in 1940 and 1941. The majority of the studies met recognized research standards; (c) sixty-three different colleges and universities produced a total of 266 studies which included 219 masters' theses and 47 doctoral dissertations. The single institution producing the most studies was New York University; (d) the normative-survey type of research had extensive use. The techniques of "literature survey," "questionnaire," "group testing," "observation," and "studied accident reports" were most commonly employed; (e) the majority of the graduate theses dealt with safety at the secondary school level; (f) the topical emphasis of "General School Safety Program" received the greatest stress. "Farm Safety" received the least amount of stress; (g) the Midwest District of the American Association for Health, Physical Education, and Recreation was the geographical area where the most studies were produced; (h) the topic of evaluation was given little emphasis by writers of graduate theses; (i) personal factors as causes of accidents were scarcely recognized in the studies; (j) schools generally favored the offering of safety instruction through emphasis in established subjects, but no evidence could be found to indicate that safety education objectives could be achieved better by correlation than by offering safety as a separate subject; (k) safety instruction lends itself to a variety of teaching methods. The choice of any one method is dependent upon available materials, the needs and interests of pupils, the time element, and local factors; (l) analysis of pupil activities and the studying of where, when, how, and why accidents occur offer the best means for selecting subject matter content; (m) failure to assign major responsibility for the organization and direction of the school safety program to one individual may handicap the program so severely that its success will be hampered; and (n) it is highly essential that attention be given to coordinating the efforts of organizations and agencies interested in promoting school safety; otherwise unnecessary and wasteful overlapping or duplication might occur.

481 pages. $6.15. Mic 57-144

EDUCATION, PSYCHOLOGY

THE PREPARATION OF THE MINISTER FOR COUNSELING

(Publication No. 19,898)

George Emil Bauder, Ed.D.
Stanford University, 1956

This study explores the function and training of the Protestant pastoral counselor and of the educational counselor. It seeks to identify (1) the relationships involved in pastoral and educational counseling, (2) the factors of both educational and pastoral counseling which may contribute toward the method and content of counselor training in each of these areas, (3) the factors of pastoral counseling which may be refined, and (4) the factors which may clarify the relationships between pastoral and educational counselors.

The first part of the study deals with assumptions, principles, and objectives in counseling; the second part, with functions and training of counselors. The third part is a synthesis involving the relationships of these factors. Conclusions and recommendations follow.

This study involves fifteen institutions offering pastoral counselor training. These were selected on the basis of geographical distribution in the United States, accreditation, denominational, and racial representation. Included are independent seminaries, university associated seminaries, and clinics. Seventy-five institutions were initially contacted by letter. Open-end questions were used in procuring information from these. The offerings of the fifteen schools used were further explored by letters, questionnaires, and personal interviews. The data received were tabulated and then returned to the institutions involved for their verification. The resulting data were used in turn to determine the factors considered in this study.

The results suggest that the extreme variations in assumptions, principles, and objectives within these spheres of counseling may indicate inconsistencies in the field of pastoral counseling. The explication of the Biblical basis, the historical development, the assumptions, principles, and objectives of pastoral counseling may ultimately revolve around the two foci of the humanistic and supernatural dimensions. Both types of counselors seek to foster individual growth toward greater personality integration, self-direction, and responsibility.

Difference is seen in the approach to training; in educational counseling the movement seems to be from the study of the normal to the abnormal, whereas, in pastoral counselor training, the abnormal receives stronger emphasis as a means of understanding the normal. Referral as a professional responsibility is more explicated in educational than in pastoral training. Research is more predominant in the training of the educational than in that of the pastoral counselor. The factors of training for the educational counselor are better articulated and show greater refinement than do those in the pastoral field.

Little reference toward understanding the duties and training of educational counselors seems to be present in the literature on pastoral counselor training. Little reference seems to be made respecting the religious life and values of the counselee in educational counseling literature.

Further research toward a more sophisticated explication of the relationship of assumptions to the other factors considered in the study is suggested as a means of developing greater consistency in point of view, direction, and procedures.

Research and experience in educational counseling are recommended for the pastoral counselor in training. Investigation and communication or experience in the areas of religious beliefs and values are recommended to those involved in educational counseling.

Effective counseling involves consideration of both individual and cultural systems of values – in this study, Christian beliefs and values. Counseling which fails to give full consideration to these value elements is seen as superficial, regardless of the sophistication of technique. Conversely, goodwill alone is seen to be superficial.

The basic conclusion of this study is that these two roles of counseling have much in common, and that each can profit from communication with and understanding of the other. 153 pages. $2.05. Mic 57-145

A STUDY OF THE ACADEMIC SUCCESS OF UNDERGRADUATE STUDENTS AS IDENTIFIED BY APTITUDE TEST PROFILES

(Publication No. 17,939)

Roscoe Allen Boyer, Ph.D.
Indiana University, 1956

This study was undertaken to investigate whether profiles of a college level orientation test battery could be used to aid counselors in the prediction of grades and major areas of concentration.

The academic records of approximately 2,000 freshman boys and 1,400 freshman girls were used in this investigation. This group was comprised of all matriculating freshmen who took the orientation tests at the Bloomington campus of Indiana University in September, 1948 and 1950. The profiles used in this study were based on the parts scores of two tests, the American Council on Education Psychological Examination for Entering College Freshmen and the Cooperative English Test, Test C2, Reading Comprehension.

Expectancy tables were constructed in the usual manner. Even though a large number of student records was involved, the frequencies for certain profiles were considered too small to provide any observable trends; therefore, similar profiles were combined. Finally a total of 38 different ACE profiles and 27 English C2 profiles was used in the development of the expectancy tables.

After all expectancy tables had been completed, a sample of 92 students was selected at random from the students who matriculated in September, 1949. By means of the expectancy tables developed in this study, the grades and probability of graduating were computed. These predictions were then compared with the students' academic histories.

Some of the more general conclusions that may be drawn on the basis of this study were as follows:

1. The number of students used in the sample was adequate to evaluate the ACE profiles for both boys and girls. However, the number of cases, particularly in the case of the girls, was not adequate for the English C2.

2. Grade-point averages tended to rise with increase

of profile elevation, regardless of profile shape or type of test.

3. On the ACE examination, when the profile elevation was held constant students whose L-score was higher than their Q-score tended to receive higher college grades.

4. Almost twice as many boys had ACE profiles in which the Q-score was two deciles or more higher than the L-score as boys whose L-score was two deciles greater than their Q-score.

5. The drop-out rate for both boys and girls during the first three semesters was constant for all five basic ACE profile shapes.

6. Low ability students, as measured by the ACE and English C2 tests, tended to receive higher grades with each successive semester they remained in school and the high ability students tended to make approximately the same grades with each semester.

7. Regardless of how boys and girls were equated in regard to test profiles, girls received higher GPA's than boys. By the end of the third semester, the average college grades for boys tended to have reached the level achieved by girls during the first semester.

8. Among students whose English C2 test scores yielded profiles of high elevation, deficiency or proficiency in either vocabulary or speed of comprehension was not reflected in the achievement of the boys.

9. Boys with high English C2 profiles with proficiency in level of comprehension consistently made higher grades than did boys with a deficiency in level of comprehension. This trend was not found among boys whose profiles were located at the middle or low level of elevation.

10. The frequency and achievement pattern associated with a particular English C2 profile shape found at one level was not found to exist at another elevation.

11. The ACE profile can not be used to aid a counselor in suggesting a particular major course of study, such as arts and sciences, business, education, and so forth.

12. No English C2 profile shape was found to be peculiar to students majoring in a particular college.

13. In a empirical test of the data presented in this study when applied to a new population, an γ of 0.45 was found between ACE profiles and predicted first semester grades and one of 0.51 was found between English C2 profiles and first semester grades. Also the prediction of the probability of college graduation of a new sample using ACE profiles resulted in an γ of 0.80. For the English C2, the γ was equal to 0.31.

Recommendations

On the basis of the findings and the conclusions of this study, the following recommendations are made:

1. The profile for the Cooperative English Test, Test C2, should be discarded, since the knowledge of the shape or scatter of the scores neither differentiates levels of achievement of students nor does the profile suggest the major subject areas which could be undertaken.

2. Standard scores should replace percentiles as units of measurement used to express scholastic ability. The policy would provide greater differentiation of students at the extremities of the ability continuum.

171 pages. $2.25. Mic 57-146

AFFECTIVE FACTORS ASSOCIATED WITH ACADEMIC UNDERACHIEVEMENT IN HIGH-SCHOOL STUDENTS

(Publication No. 19,771)

Clyde Wesley Bresee, Ph.D.
Cornell University, 1956

This study, through the use of both structured and unstructured tests, compared a group of academic underachievers with a group of achievers of similar intellectual capacity. Students in both groups had IQ's greater than one standard deviation above the mean; 44 students whose grade-point average was "B" or better were designated as achievers, and 33 with grade-point averages of "D" or poorer were designated as underachievers. It was hypothesized that the two groups would differ significantly as follows:

1. Underachievers would give expression to more manifest hostility on a sentence completion test.
2. Underachievers would reveal more extrapunitiveness on the Rosenzweig Picture-Frustration Test.
3. Goals and values of the two groups would be unlike.
4. Underachievers and achievers would differ in certain aspects of self-concept.

The semi-structured instruments used were: a sentence completion test, three statements about the self, a personal essay, and the Rosenzweig Picture-Frustration Test. The structured instruments were: the Sims SCI Occupational Rating Scale, the Maslow Security-Insecurity Inventory, the Gordon Personal Profile, and the Study of Values. Both groups were also given the Cooperative Reading Test – Lower Level.

Findings: The semi-structured instruments proved to be the more effective in distinguishing between the two groups. The underachievers differed significantly from the achievers in expressing more hostility and extrapunitiveness. The expressed goals of the achievers were significantly different from those of the underachievers in being more remote and in requiring more formal preparation. The groups also differed significantly in the nature of their reported self-identifications, the achievers tending to identify with friends, family, and community. The achievers obtained significantly higher ratings in expressions of altruism.

Differences between the groups which were non-significant, but in the direction hypothesized, were as follows: the underachievers gave more expression to feelings of insecurity, placed their families lower on the occupational scale, saw themselves as less ascendant and less responsible, and displayed more concern over physical characteristics than the achievers.

The achievers were found to have significantly better vocabularies than the underachievers, but the groups did not differ significantly in total reading score.

Conclusions: While the underachievers appeared to be less efficient generally in interpersonal relations and to have less favorable personalities, they differed from the achievers most markedly in the nature and remoteness of their occupational goals, in expressions of altruism and "other-centeredness" and in expressions of hostility. The similarity of the two groups with respect to intellectual capacity and reading proficiency emphasizes the importance of the affective areas in which the achievers and underachievers were found to differ. The group findings

should be interpreted cautiously in dealing with individual cases because of the considerable amount of overlapping.
184 pages. $2.45. Mic 57-147

PERSONALITY THEORIES UNDERLYING TWO VIEWS OF COUNSELING

(Publication No. 19,913)

Crittenden Edwards Brookes, Ph.D.
Stanford University, 1956

This study investigated theoretical differences underlying opposed counseling techniques suggested by the directive and nondirective views of counseling. An overview of nondirective personality theory, and of the nondirective counseling goal, was derived from the work of Carl Rogers and his close associates. An overview of directive personality theory, and of the directive counseling goal, was derived from the work of F. C. Thorne. These overviews were subjected to analysis by means of a framework based upon current concepts of the nature of psychological theory. This framework suggests that adequate predictive theories in psychology must include the following: (a) antecedent events, consisting of precisely measurable external stimuli which impinge upon the individual. (b) Consequent events, consisting of precisely measurable behaviors related either directly or indirectly to the antecedent stimuli. (c) Intervening constructs, interposed between antecedent and consequent in order to provide meaningful interpretation of antecedent-consequent relationships, and tied operationally to both antecedent and consequent.

It was concluded that methodological differences between the nondirective point of view and the directive point of view expressed by F. C. Thorne appear to be traceable to the following:

1. Nontheoretical factors, including differences (a) as to whom should be assigned the responsibility of selecting counseling goals, (b) in philosophical evaluation of counseling goals, (c) in interpretation of client expectations, (d) in the degree of importance placed upon external situations over which the client has no control, and (e) in relative stress upon immediate versus long-term counseling goals.

2. Theoretical factors, including differences (a) in estimation of ego-intergrative forces in situations producing psychological threat, (b) in interpretation of the integrating functions of higher-level processes such as intelligence and volition, (c) in interpretation of the importance of the time factor in the assimilation of threatening experiences, (d) in views as to the organization of behavior on varying levels of physiological complexity, and (e) in type or range of behaviors covered by each theory.

The theoretical formulations of these views of counseling are considered inadequate to a systematic justification of counseling method, to the extent that (a) they utilize the subjective or phenomenal frame of reference as a basis for theoretical postulation, (b) they fail to define concepts in terms of their operations, (c) they utilize as data subjective and non-repeatable report of the behaver, or inferences derived from non-repeatable observations, (d) they overgeneralize from a restricted range of behavioral data, (e) they utilize theoretical constructs (processes) which are not defined by reference to objective, consistently-measurable events, (f) antecedent and consequent events cannot be differentiated precisely from constructs interjected between antecedent and consequent, (g) they fail to provide postulates suitable for nomothetic as well as for idiographic prediction, (h) eclectic choice of counseling method inhibits the formulation of internally consistent explanations of behavior, (i) they arbitrarily dichotomize between directive and nondirective counseling techniques, (j) they posit counseling goals which imply an external teleology.
121 pages. $1.65. Mic 57-148

A COMPARATIVE ANALYSIS OF PUPIL PERFORMANCE ON CONVENTIONAL AND CULTURE-CONTROLLED MENTAL TESTS

(Publication No. 18,603)

William Louis Fowler, Ph.D.
University of Michigan, 1956

This investigation has been concerned with the relative mental test performance of 355 Detroit and Hamtramck, Michigan, ten-year-old pupils from fourteen elementary schools and three race-ethnic groups.

The purpose of this study has been to compare pupil test performance with sex, race, ethnicity, socioeconomic status, and teacher opinion of pupil intelligence.

Each pupil took the following six tests:

Conventional tests:

1. California Short-Form Test of Mental Maturity, Elementary, Grades 4-8, 1950, S-Form.
2. Detroit Alpha Intelligence Test, Grades 4-8, Form 8630.
3. The Henmon-Nelson Tests of Mental Ability, Form A, Elementary School Examination, Grades 3-8.

Culture-controlled tests:

1. IPAT: Test of g: Culture Free, Scale 2, Form A.
2. IPAT: Test of g: Culture Free, No. 2B.
3. Davis-Eells Games, Elementary-A.

In the pupil sample were 201 white American nonethnics (106 girls and 95 boys); 70 Negroes (37 girls and 33 boys); and 84 Polish (44 girls and 40 boys). All pupils were selected from representative geographical urban areas.

The following are the study's hypotheses and findings. Differences at the 5 percent level, and lower, were considered to be significant.

Major Hypothesis

1. A larger positive correlation will obtain between conventional mental tests and socioeconomic status than will obtain between culture-controlled mental tests and socioeconomic status.

Though, in general, a low and positive relationship exists between socioeconomic status and pupil performance on each of the six tests, this hypothesis is unsubstantiated.

Minor Hypotheses

1. There will be no significant difference between the scores of boys and girls on the conventional tests.

An analysis of the data does not substantiate this hypothesis. On the Henmon-Nelson and the Detroit Alpha, the girls' mean scores are significantly higher than the boys'.

2. Girls will score significantly lower than boys on the culture-controlled mental tests.

The study data do not warrant such an assumption.

3. Negro pupils will score on all tests significantly lower than both categories of white pupils.

This hypothesis is unsubstantiated. In six instances Negro pupils were not significantly different; in ten instances they were significantly lower in mean performance.

4. American-born Polish pupils will score lower than white American nonethnic pupils on both types of tests.

This hypothesis is unsubstantiated. In only four out of thirty-two t tests were the white American nonethnics superior. This superiority may have occurred through chance.

5. Teacher judgments of pupils' mental ability will correlate in a positive direction with the culture-controlled tests.

This hypothesis is accepted. All three r's were 0.33+.

6. Teacher judgments of pupils' mental ability will correlate higher in a positive direction on the conventional than on the culture-controlled mental tests.

A study of the data indicates that this hypothesis is acceptable. However, only the Detroit Alpha and the Henmon-Nelson have significantly larger r's than each of the three culture-controlled mental tests.

7. The correlations between the verbal and nonverbal sections of the California Mental Maturity and the Detroit Alpha tests will be positive and significant.

The data substantiate this hypothesis. The obtained r for the Detroit Alpha test is significantly larger than the obtained r for the California Mental Maturity test.

8. There will be a higher positive correlation between the verbal and nonverbal sections for boys than for girls on both the California Mental Maturity test and the Detroit Alpha.

This hypothesis is unsubstantiated.

220 pages. $2.85. Mic 57-149

THE PARENT-TEACHER CONFERENCE: ATTITUDES OF PARENTS AND TEACHERS AS ASSOCIATED WITH SUCCESS IN THE CONFERENCE

(Publication No. 19,901)

Bernhard William Gerdes, Ed.D.
Stanford University, 1956

The question of association between attitudes of parents and teachers, and success of conferences between parents and teachers was posed for inquiry. It was assumed that conferences are an accepted educational procedure; and that parents' and teachers' attitudes toward children are basic and primary in any relationship regarding children's education today.

The purpose for the study was to provide a basis for greater teacher and administrator insight into conferences and their improvement for increased benefits to children.

Twenty-two teachers in grades one through three and forty-four parents with children in these grades in a California community assisted in the investigation. Attitudes were measured with the MINNESOTA TEACHER ATTITUDE INVENTORY, Form A, as a total test and as a test divided into five areas of policy, practice and thought – "moral status of children," "discipline and conduct," "child development and behavior," "principles of education," and "personal reactions."

Each teacher selected one good and one poor parent conferee who represented successful and unsuccessful conferences respectively. Teachers' and parents' responses to items of the MTAI served as the basic data for study. Each individual responded to the MTAI first for himself and then as though he were another person. Teachers did this for self and each of his chosen parents. Similarly, parents did this for self and for the teacher selector.

The analysis of the data was in terms of agreement and understanding. Agreement was defined as similarity between self-reported scores; and understanding as similarity between prediction scores and self-reported scores of those predicted. Comparisons were made by testing means with Fisher's "t" test, and through rank order correlations (rho) between self-reported and prediction responses of the three groups, teachers, good conferees, and poor conferees, in appropriate combinations.

It was concluded that agreement was not primary in successful parent-teacher conferences. Understanding, particularly that of parent by teacher, was of greater significance. This was revealed through significant correlations of 0.44 at the 5% level and 0.65 at the 1% level between teachers' predictions of good and of poor conferees and the self-reported responses of each of these parent groups respectively. The areas of "personal reactions" and "discipline and conduct" were respectively the clearest and least clear sources of difficulty in parent-teacher relations. Increased agreement and understanding are necessary in the areas of "child status," and "principles of child development and behavior"; and in educational philosophy, administrative procedures, and the curriculum and its implementation. There was a slight trend toward a more successful conference between parents and teachers who agreed with and understood each others' attitudes than between those who neither agreed with or understood each other. Both parent and teacher tended to predict each

other as each himself felt. Teachers in general were better predictors of parents than parents were of teachers. Both teachers and parents underestimated the attitudes of each other.

It is recommended that those responsible for improving children's educational opportunities work with teachers and parents to improve conferences. Teachers should be assisted in becoming more fully informed on matters of child development, behavior, and the school's educational philosophy, administrative policies and procedures, and the curriculum and its implementation. This can serve as the basis for providing important information for parents and possibly effecting their understanding of modern education. Teachers should approach a conference with positive attitudes toward the parent and the child, assessing attitudes realistically rather than underestimating the parent's attitudes. Teachers should be able to identify and discuss with parents the areas of disagreement, misunderstanding, and antagonism, and attempt to overcome these by removing the reasons for their existence through intelligent two-way communication with parents.

151 pages. $2.00. Mic 57-150

AN INTERRELATION OF VALUE-ATTITUDE STRUCTURE AND ROLE PERCEPTION AMONG SCHOOL TEACHERS AND ADMINISTRATORS

(Publication No. 17,159)

August F. Kerber, Ed.D.
Wayne University, 1956

Adviser: Dr. Lloyd Allen Cook

Purpose

The central problem of this investigation concerns the functional relationship that is assumed to exist between a person's value-attitude structure and role perception. The research work was conducted within the institutional framework of the public schools and involved a preselected sample of subjects possessing a known value orientation. The main research objectives were to measure the attitudinal configuration and homogeneity of the different person types in the field of education and the manner in which role relationships were perceived and defined within the organizational structure of the school. The main measurement emphasis was focused upon such aspects of the school organization as interpersonal relations, status, the authority structure and the division of labor. One further objective was to appraise the relative efficiency of "Q" techniques in educational research.

Assumptions

The underlying hypotheses of the study design are related to "Q" methods and involve the following: (1) that any given person is liberal or conservative to some degree habitually; that if a continuum were set up ranging from extreme conservatism to extreme liberalism all persons would fall somewhere along this line; (2) that these person-types will be related to cultural stereotypes or ideal person-types, such as typical conservative or liberal; (3) that teachers or administrators of a given type or value-attitude structure will show a marked similarity in their educational values and behavioral roles and expectations, and that there is a functional and selective relationship between values and roles; (4) that the internal organization and interrelationship of values and attitudes will be more contradictory and confused for the middle group than for the extreme groups on either side; (5) that different person-types have varying value attitude structures and that these differences have sufficient dimensionality as to be measured by means of a person to person correlation or comparison.

Methodology

The methodological procedures involved the use of two "Q" sorts which were structured into factorial designs. The data from the card sorts were processed in three different ways; (1) pile placement profiles based upon card distribution patterns; (2) analysis of variance; (3) item analysis using pile placement averages.

Findings

The three methodological procedures produced mutually supportive results concerning the different groups of subjects. The following conclusions should give some indication of how the various groups compared with one another; (1) Each of the three groups, liberals, conservatives and the middles, was highly homogeneous. The sort arrays and pile placement profiles gave clear evidence that in each group there were individual differences but that these variations did not affect a fairly distinct emergence of similar group characteristics. (2) Each group was marked by varying degrees of internal consistency with respect to its value attitude structure. The liberals proved to be most consistent, with the conservatives second, and the middles third. (3) Different school roles (teacher or administrator) did not have a significant effect upon the basic value-orientation of the individual. (4) All subjects tended to modify their general attitudes towards education when they were applied to specific in-school situations. The extreme conservatives had the least variation of all of the groups. (5) An individual's value-attitude structure was highly predictive of his whole view of education and in-school relationships indicating that the most effective way of grouping teachers might be in terms of value differences. (6) The "Q" technique proved to be an effective though complicated research method with many potential applications in the educational research field. The areas that seem most suited to the use of "Q" techniques are counseling and guidance and special education.

219 pages. $2.85. Mic 57-151

AN EXPERIMENTAL STUDY OF THE EFFECT OF EXTERNAL DIRECTION DURING LEARNING ON RETENTION AND TRANSFER

(Publication No. 17,511)

Jack Edward Kittell, Ph.D.
State College of Washington, 1956

To obtain evidence of the effect of different amounts of direction on learning, transfer, and retention, 132 sixth-grade pupils were divided by stratified-random selection into three groups of 43, 44, and 45.

After determining that the three groups did not differ significantly as to I.Q. means nor mean scores on a pre-training test, a different amount of direction was provided each group during a five-week training period. One group received Minimum direction consisting of organization of materials and information that organization existed. The second group received Intermediate direction which, in addition to the clues provided in Minimum direction, included short statements of underlying principles. The third group received Maximum direction which, in addition to the clues furnished in Intermediate direction, specified correct responses in advance of discovery.

Procedures consisted of presenting experimental materials consisting of items composed of five English words, one of which did not belong with the others for some reason. The materials were organized by dividing items into groups of three. Each group of items was based on an underlying principle. During the five-week training period, each subject received training three times on each of fifteen principles.

After training, tests were administered to measure transfer to three types of situations: type (a), previously encountered items and principles; type (b), new items and previously encountered principles; and type (c), new items and new principles. The pre-training test was administered for a second time after the training period to measure type (a) transfer. An alternate form of the pre-training test was administered to measure type (b) transfer. Another test was administered to measure type (c) transfer. After two and four weeks, the pre-training test was administered for a third and fourth time to measure retention of type (a) transfer.

The statistical techniques used in this experiment included chi-square, analysis of variance, t tests, and analysis of variance by ranks.

The hypothesis that Intermediate direction is superior to Minimum and Maximum direction in promoting learning and transfer to type (a) situations was not fully confirmed. Intermediate direction was significantly superior to Minimum direction at the .02 level but there was no significant difference between Intermediate and Maximum direction in effecting transfer to these situations.

The hypotheses that Intermediate direction is superior to Minimum and Maximum direction in promoting learning and transfer to types (b) and (c) situations were confirmed at the .001 level of confidence.

The hypothesis that Intermediate direction is superior to Minimum and Maximum direction in effecting retention of type (a) transfer for two and four weeks was confirmed at the .01 and .001 levels of confidence.

The hypothesis that Intermediate direction lessens the dependence of transfer on mental ability to a greater extent than Minimum or Maximum direction was not fully confirmed. Intermediate direction was superior to Minimum direction at the .02 level of confidence but there was no significant difference between Maximum and Intermediate direction in this respect.

Evidence provided by the experiment indicates that:

1. In addition to organizing materials used in learning, teachers should aid pupil discovery by suggesting meaningful relationships on which learners may base discovery and by providing practice with those relationships.

2. Providing statements of underlying relationships without specifying answers, fosters learning, transfer, and retention in different situations.

3. Providing direction to learners in the form of underlying relationships encourages searching, discovering, and applying which are more effective processes in solving new problems of similar types in the future than relying on rote memory. 160 pages. $2.10. Mic 57-152

AGE CHANGES IN TACHISTOSCOPIC SPAN

(Publication No. 19,705)

Robert Charles Leestma, Ph.D.
University of Michigan, 1956

The primary purpose of this study was to construct growth curves of tachistoscopic span for four different kinds of material varying in meaningfulness: digits, unrelated letters, unrelated words, and related words. Specific questions investigated involved the form of the curves, amount of growth, rate of growth, level at which growth ceased, and sex differences for each kind of material. Related questions dealt with the relationship between different methods of measuring tachistoscopic performance, the relationship between tachistoscopic span and reading ability, the relationship between tachistoscopic span and intelligence, and the interrelationships between these three measures.

Subjects were 261 pupils from the Saline Area Schools. They represented all of the seven-, nine-, eleven-, thirteen-, fifteen-, and seventeen-year-old pupils in the Saline Elementary and High School who had neither failed a grade nor been double-promoted. The subjects were about equally distributed throughout the six age levels. As a group at each age level, they were average in reading ability and intelligence as measured by the California Reading Test and the California Short-Form Test of Mental Maturity.

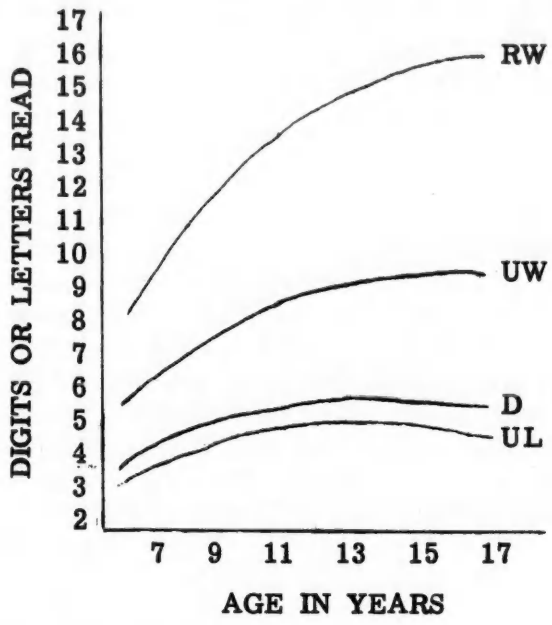
The same tachistoscopic material was employed with all of the subjects. Word material was of second grade difficulty. Ceiling was provided by varying the amount of material exposed. Exposure time was approximately 100 ms.

The following data were secured for each subject: chronological age, mental age, intelligence quotient, reading age, and a threshold and a modified threshold score for tachistoscopic perception of digits, unrelated letters, unrelated words, and related words.

The study utilized the cross-sectional approach. Growth curves were plotted from age group means. Second degree curves based on the least squares method and utilizing the actual individual ages rather than group means were also fitted to both types of scores for all four kinds of material. Appropriate statistical methods such as F and t tests, a nonparametric procedure, and measures of goodness of fit were employed in the analysis of the data.

The specific findings may be summarized as shown on the following page. (1) Significant growth over the age range studied was found for all four kinds of material. (2) Amount of growth was directly related to meaningfulness of material. (3) Rate of growth was most rapid during the early years studied. Beyond ages nine or eleven, growth was generally decelerated. (4) Growth continued until at least age thirteen and possibly until age fifteen.

The growth curves for threshold span plotted from the sample mean data for each age group for each kind of material are shown to the right.



With unrelated letters, however, growth probably continued to at least age seventeen. (5) Relatively few mean significant sex differences were found. Where they occurred they consistently favored the girls. More significant sex differences occurred with meaningful material than with meaningless material, and more in the eleven-year-old group than at any other age level studied. Individual differences exceeded mean sex differences and mean age group differences. The range of individual differences increased with the meaningfulness of the material. (6) The average correlation between the threshold and modified threshold scores for each kind of material was .82. The average intercorrelation of the modified threshold scores was .57 and significantly higher than the average intercorrelation of the threshold scores, .46. (7) The average correlation of reading age with tachistoscopic threshold span was .51 and with modified threshold span, .57. The difference between these two correlations was not significant. The size of the correlations tended to increase with the meaningfulness of the material. (8) The average correlation of mental age with tachistoscopic threshold span was .35 and with modified threshold span, .40. The difference between these two correlations was not significant. (9) The average intercorrelation of the tachistoscopic threshold scores and the average correlation of reading age with the tachistoscopic threshold scores were significantly higher than the average correlation of mental age with the tachistoscopic threshold scores. The same significance pattern prevailed with modified threshold scores.

For the subjects studied under the conditions specified, the following conclusions were drawn: (1) The more meaningful the material: the larger the span, the more growth occurs with time, and the higher the relationship of span with reading ability. (2) Tachistoscopic span is more closely related to reading ability than to intelligence. (3) Differences in tachistoscopic span between individuals are not primarily the result of differences in intelligence, but rather of acquired differences in the assimilation of meaning. (4) Growth in tachistoscopic span continues longer with meaningless material than with meaningful material. (5) Threshold and modified threshold scores generally are not interchangeable measures.

375 pages. $4.80. Mic 57-153

FACTORS RELATED TO MORAL JUDGMENTS OF CHILDREN

(Publication No. 19,929)

Frederick Joseph McDonald, Ph.D.
Stanford University, 1956

This study is an attempt to determine measurable patterns of behavior in the moral judgments made by children, and to relate identifiable patterns to the variables of age, sex, social class, and intelligence.

Seven hundred and ninety-two public school children, between the ages of eight and fifteen, were given a test instrument which consisted of six pairs of stories. The stories described acts of theft by children. One of the paired stories involved a theft from an individual; in the other, the victim was a corporate group, such as a factory or a department store. The subjects were asked to identify the child in each pair "who did the worst thing," and to give a reason for the choice. The choices and the reasons for them comprised the data analyzed in this study.

Each child in the study was classified into one of ten reason-types on the basis of the dominant theme represented in the reasons given for his choices. These response patterns proved to be stable when a subsample of the subjects was given a comparable set of stories three weeks after the original testing.

Each child in the sample was classified on the basis of reason-type, age, sex, social class, and intelligence level. Contingency tables were constructed from this information, relating reason-types to age, sex, intelligence, and social class. Chi-square analyses were performed to test association between reason-types and each of these variables.

The analysis of the data demonstrated that children could be reliably categorized into several types on the basis of the dominant theme expressed in their stated reasons. The majority of children are classifiable as "moral absolutists," "individual-minded," or "corporate-minded," these classifications indicating that, in the majority of instances, they chose on the basis of the principle that stealing is always wrong, or on the basis of a concern for the needs of the individual victim of the theft, or on the basis of concern for the needs of the corporate group and its status as a power figure capable of punishing. The data strongly suggest that identifiable and stable patterns appear in the moral judgments made by children.

The analyses of the association between reason-types and age, sex, social class, and intelligence demonstrated that the kinds of moral judgments made are significantly associated with sex and social class. No association was found between age and the kind of judgments made. A significant relationship between intelligence and the kinds of judgment made was found among females but not among males.

In general, lower class children of both sexes tended to make more judgments on the basis of the principle that stealing is always wrong. Upper class males appeared to be more "corporate-minded," while upper class females appeared to be more "individual-minded." A hypothesis is suggested that such differences might be explainable in terms of variations in identification factors in the social classes.

In general, males differed from females in that females made more judgments on the basis of the principle

that stealing is always wrong. More males than females judged the morality of an act of theft in terms of the value of the object stolen. Females of low intelligence made more judgments in terms of an invariant principle than do females of average or high intelligence. A hypothesis is suggested regarding the kinds of differential antecedent learning experiences of males and females that may produce these differences. 100 pages. $1.50. Mic 57-154

THE DYNAMICS OF CREATIVITY: AN INTERPRETATION OF THE LITERATURE ON CREATIVITY WITH A PROPOSED PROCEDURE FOR OBJECTIVE RESEARCH

(Publication No. 19,286)

James Melvin Rhodes, Ph.D.
University of Arizona, 1957

Supervisor: C. B. Merritt

This dissertation offers three contributions to the fund of knowledge. First, it brings together and organizes a mass of writings about creativity and related concepts. Secondly, it presents a comprehensive theory of creativity, synthesized by the author from insights revealed during study of the subject and from personal contacts with creative children. Thirdly, it introduces and describes a new procedure for investigating the dynamics of creativity by actually studying children who create. The term dynamics (of creativity), as used in this dissertation, refers to the moving moral, as well as physical, forces of any kind, or the laws relating to them, which produce or change thinking leading to the articulation of new ideas and products.

The discourse is presented in nine chapters. Chapter I is introductory: it explains the nature of the problem to be dealt with and the need for research. Chapter II deals with semantic problems: the term creativity has a variety of meanings, each of which is seen as a facet of a complex concept. Chapter III reviews methods which have been used in other investigations having similar objectives. Chapter IV discusses various kinds of ideas and products and attempts to classify such articulations according to a scheme which reflects different levels and inclinations of perceptual orientation. Chapter V reviews and interprets writings about the personality structure of individuals who show superior creative ability. Chapter VI reviews and discusses various theories pertaining to the creative process. Chapter VII discusses theories concerning the motivation of creativity. In Chapter VIII the author formulates a comprehensive theory of creativity based upon insights revealed in the preceding chapters. The final chapter introduces a new procedure for use in studying children who create. This procedure is adaptable to the study of all levels and frequencies of creativity. It is proposed as a method suitable for these purposes:

1. To compare and contrast the dynamics apparent in the lives of children who are producing tangible products, with the dynamics apparent in the lives of children who are not producing tangible products.
2. To compare and contrast the dynamics apparent in the lives of children who create different kinds of things.
3. To follow, longitudinally, the creative development of specific children in the hope of gathering insights concerning the dynamics related to successive articulations.

The theoretical chapters in this dissertation are submitted to educators for consideration as possible course material to be added to the program of teacher education.

The new procedure is submitted to educators for consideration as a method of potential value in teaching for and evaluating creativity. The potential value of the procedure is illustrated with twenty-two lithographed plates, which show some of the kinds of things elementary school children create, and with a figure entitled, The Creativity Classification Graph. The graph is an instrument to be used in cataloging various kinds and degrees of creativity.
285 pages. $3.70. Mic 57-155

FACTORS RELATED TO THE UNDERACHIEVEMENT OF HIGH SCHOOL STUDENTS

(Publication No. 19,909)

William Gerald Stoner, Ed.D.
Stanford University, 1956

Statement of the Problem

This was an exploratory study of factors, other than intelligence, which were related to the underachievement of high ability students. A group of high school students, of high aptitude as measured by intelligence tests, were used as subjects to explore by means of standardized tests and self-report devices, a wide range of factors which were related to differential achievement. The purpose of the study was to identify some of these factors as topics for further research.

Procedure

The subjects were 1160 eleventh grade students enrolled in the San Mateo Union High School District, San Mateo, California. From this group, 275 students with IQ's of 120 or higher, as measured by the Terman-McNemar Test of Mental Ability, were selected for this study.

The Iowa High School Content Examination was administered to the 275 students. An underachiever group was selected to include the 35 students who were lowest in percentile score on the total test. An achiever group was selected to include the 35 students who were highest in percentile score.

Treatment of the data indicated a significant difference (5% level) between the means of the underachievers and achievers in total achievement test score and IQ score. To control the variable of intelligence, underachievers were matched with achievers on the basis of IQ score. This procedure yielded a matched group of nineteen pairs of students. The difference between the mean IQ score for the matched group was not significant. The difference between the mean achievement test score for the matched group remained significant.

The Diagnostic Reading Tests Survey Section was administered to the members of the matched group. Treatment of the data indicated a significant difference (5% level)

between the underachievers and the achievers in the area of comprehension and total test score.

The California Psychological Inventory was administered to the matched group. Treatment of the data indicated significant differences (5% level) between underachievers and achievers on five of the seventeen scales which were scored.

A wide range of data from the unmatched group of 35 underachievers and 35 achievers was collected. A questionnaire of 180 items was developed to provide descriptive information about the group. The questionnaire was divided into two parts. Part one reported data to furnish a more complete description of the group. Part two was designed for the purpose of developing a cluster of items which could be described and used with succeeding groups as an instrument to discriminate between underachievers and achievers.

General Conclusions

(1) The results from the Reading Tests indicate that the underachievers have more reading handicaps than the achievers and comprehend less well the type of reading material measured by this test.

(2) The underachievers are described by the following adjectives associated with the 5 scales of the California Psychological Inventory:

(a) Dominance – commonplace; indifferent; inhibited; retiring; silent; unassuming.
(b) Socialization – defensive; demanding; opinionated; resentful; stubborn.
(c) Intellectual efficiency – cautious; confused; easy going; mild; shallow; unambitious.
(d) Psychological interests – apathetic; considerate; peaceable; retiring; serious; unassuming.
(e) Flexibility – insightful; rebellious, touchy; assertive; humorous; informal.

(3) The underachievers were aware of their academic weaknesses and also of possible reasons for these weaknesses.

(4) More underachievers than achievers believed that they were misunderstood by their teachers.

(5) Fewer underachievers than achievers believed that they were living up to the expectations of their parents.

(6) The underachievers were not as sure of their future educational plans as were the achievers.

113 pages. $1.50. Mic 57-156

THE INFLUENCE OF PARENTAL ACCEPTANCE ON SELECTED SELF FACTORS IN CHILDREN

(Publication No. 17,822)

Carl D. Tatum, Ed.D.
University of Maryland, 1956

Supervisor: Professor H. Gerthon Morgan

Purpose

The purpose of this study was to determine the degree of acceptance parents felt toward their children and compare it with the ranked scores of their children in self-acceptance, academic efficiency, and peer ratings.

Procedure

The parents of 49 fourth grade children (80 parents) were interviewed. The interviews were graded on a five point scale of acceptance from Very Accepting, through Accepting, Neutral or Ambivalent, and Rejecting, to Very Rejecting. The data were gathered through an open-question interview technique using six general questions which were designed to reveal parent attitudes of acceptance toward their children.

The 49 children were given personality tests, mental and achievement tests, and a peer rating scale. The children were ranked according to their scores in the above areas as determined by the tests.

Parents' rank order of acceptance was correlated with each of the children's ranks in the areas of self-acceptance, academic efficiency and peer rating.

The basic hypotheses of this study are:

If parents show a high degree of acceptance for their children the children will:

1. Score high on self-acceptance
2. Score high on academic efficiency
3. Be rated high by their peers

A criterion for determining parents' degree of acceptance was formulated. Judges were used to establish the validity of the parent acceptance scores. Reliability was established by a check four weeks after the data were analyzed.

Findings

Hypotheses 1 and 3 were supported by a positive correlation at greater than the .01 level of statistical significance. Hypothesis 2 was not supported. There was a negative correlation at no measurable level of statistical significance.

From the present research it may be concluded that there is a statistical significant positive relationship between what appears to be parent acceptance of their children and the way children regard themselves and are regarded by their peers. There is a negative but not statistically significant relationship between what appears to be parent acceptance of their children and children's academic efficiency as determined in this study.

The present research would indicate that an atmosphere of acceptance is so important in the formulation of the child's functioning self that teachers and educators should not only redouble their efforts to provide such atmosphere in their own relations with children, but also help parents become more cognizant of this need.

The present research also indicates that simple research designs based on open-question interviews may be easily adapted and used by teachers in determining the psychological atmospheres in which their children live.

103 pages. $1.50. Mic 57-157

THE EVALUATION OF ITEM SELECTION TECHNIQUES APPROPRIATE TO A NEW RESPONSE METHOD FOR MULTIPLE-CHOICE TYPE TEST ITEMS

(Publication No. 19,729)

Frank Burton Womer, Ph.D.
University of Michigan, 1956

The conventional response method to a multiple-choice item requires the selection of the one answer from among the answer and distracters offered. It is scored one or zero. Partial information can lead to a score of either one or zero.

A new response method has been proposed which requires the selection of distracters. This method is scored plus one for each distracter marked and minus three for an answer (four-choice item). The maximum item score is plus three, the minimum is minus three, and all intermediate integral scores are possible. This seven point item score scale offers the possibility of differentiating between varying degrees of partial information and partial misinformation.

For the conventional method biserial r and point biserial r were used as discrimination indices and per cent passing as the difficulty index. For the new method product moment r was used as the discrimination index and the item mean score as the difficulty index. The difference between per cent passing and item mean score for high versus low scoring groups was used as a short-cut discrimination index. Ferguson's delta was tested as an item index.

In order to evaluate these indices, three tests were developed and three matched groups of high school juniors and seniors were used as subjects. Each group took one of the tests by the conventional response method and a different test by the new response method. Each group was split into equivalent halves to determine the reliability of the indices chosen and for cross-validation purposes.

The results were as follows:

1. The item mean score, as an index of item difficulty for the new response method, has the same high reliability as the per cent passing for the conventional response method and is closely related to it.

2. The difficulty of a distracter, measured by the per cent of people recognizing the distracter as wrong in the new response method, is highly related to the per cent of people selecting the distracter as the answer in the conventional response method.

3. Product moment r, as an index of item discrimination for the new response method, has the same degree of reliability as the conventional biserial r and point biserial r. Large groups are required for very stable item discrimination indices. Of the three indices, biserial r tends to yield the highest discrimination indices and point biserial r the lowest.

4. Item selection based on indices used with the new response method has the same general effectiveness in improving test reliability as item selection based on indices used with the conventional response method, with the possible exception that the former may be better for constructing difficult tests, the latter for easy tests.

5. The difference in item mean scores between upper and lower groups is an effective short-cut index of item discrimination. A large difference is associated with a large item-test correlation, but a small difference is not necessarily associated with a small item-test correlation.

6. Ferguson's discrimination index, delta, is highly and non-monotonically related to item difficulty, but is not related to conventional item-test correlational indices.

167 pages. $2.20. Mic 57-158

GROUP STRUCTURE CORRELATES OF GROUP PROBLEM-SOLVING PROCESSES

(Publication No. 19,731)

Robert Charles Ziller, Ph.D.
University of Michigan, 1956

The study is the first in a series designed to discover means of improving the ability of groups to solve problems. As the initial effort, it is the objective of this study to explore the relationship of some group structure variables to group problem-solving processes and attendant affective group member behavior. The independent variables include the leader's F-Scale score (interpreted as a measure of egocentricity), a measure of the leader's concern about disagreeing with the group members on an issue vital to the group as a whole (interpreted as a measure of group centeredness), leadership acceptance, and group attraction. The dependent variables included group adaptability, group confidence, and source of approved suggestion.

Ninety-five aircrews comprising about one thousand men were the subjects of the experiment. The group task required the completion of an eight-item intelligence examination in a period of time which did not permit an individual or discussion group to solve all the problems efficiently. Prior to the task, the group members responded to a question designed to provide an index of their confidence in the group's ability to perform well in a new situation. During the group problem-solving session, an observer recorded the group's approach to the task and the names of those whose suggestions as to the approach were accepted. Following the problem-solving session, the group members completed the California F-Scale and the "Group-Centeredness" Scale.

With reference to the confidence of the group members in the ability of the group to perform well in a problem situation, the highest confidence was expressed by groups with a high index of group attraction, and in which leaders expressed great concern about disagreeing with the group on an issue vital to the group as a whole.

It was also found that groups which adapted most successfully to the requirements of the problem were led by individuals with low F-Scale scores who were moderately concerned about disagreeing with the group.

The measures of group cohesiveness appeared to be involved only in conjunction with the independent leadership variables. These findings and the indications that leader "egocentricity" and "group-centeredness" are psychological complementary emphasize the need for further research in which pattern analyses are employed involving leader and group variable conjointly. Thus, it was hypothesized that in groups in which the leader and group members F-scale score are homogeneous, the group members and leaders are mutually

reinforced, whereas heterogeneity of attitudes results in interpersonal conflict. Research in this direction is suggested. 96 pages. $1.50. Mic 57-159

EDUCATION, TEACHER TRAINING

AN INVESTIGATION TO DETERMINE THE EFFECTIVENESS OF A COURSE IN THE PREPARATION OF INEXPENSIVE INSTRUCTIONAL MATERIALS

(Publication No. 17,761)

Walter Louis Brown, Ed.D.
Indiana University, 1956

Chairman: Carolyn Guss

The Problem

The problem is to determine the effectiveness of the course, Preparation of Inexpensive Instructional Materials – R543, at Indiana University. The subproblems include the following:

1. To determine the degree to which the course has influenced subsequent use of the graphic processes that were emphasized in the class.
2. To determine the teaching materials that are being produced and to determine the extent to which the teacher has applied the interaction of these techniques (mounting, lettering, coloring, and high contrast photography) in the production of inexpensive materials.
3. To determine the effect of a knowledge of graphic materials on teaching methods.
4. To determine, by analysis, the evaluation of the course content and to make recommendations for improvement whenever justified.

Procedure

An analysis form was developed in order to collect information relative to the effectiveness of the course. This instrument was organized under the headings: (1) General Information, (2) Course Influence, (3) Application of Techniques, (4) Production Activities, (5) Utilization of Materials and Techniques, and (6) Evaluation of the Course.

Personal interviews were used to collect additional information concerning the preparation of inexpensive instructional materials. These interviews provided information from principals, teachers, and audio-visual directors concerning production activities within 12 selected Indiana schools.

Major Findings

1. Postcourse use of the four graphic techniques that were taught during the course at Indiana University had gains over reported precourse use.
2. Insufficient training was not a deterrent to postcourse production activity among participants.
3. All graphic processes were being employed for the production of visual materials.
4. Limited physical facilities within schools, the lack of free time during the regular school day, and inadequate materials and equipment were predominant deterrents to the local production of materials.
5. A total of 4,962 graphic instructional materials were produced by the participating teachers during one semester.
6. Commercially produced materials were not generally meeting all the needs of the participants. Teachers were supplementing commercial materials for specific classroom situations.
7. An understanding of the graphic techniques was listed by 95 per cent of the teachers as contributing to the solutions of many instructional problems.
8. Pupil participation in the production of visual materials was considered an important classroom activity.
9. The course was evaluated by all participating teachers as beneficial. Course instruction was rated high in terms of challenges presented, encouragement given, and the method of employing practice and theory.

Conclusions

1. Teachers who have taken the course, Preparation of Inexpensive Instructional Materials, at Indiana University are using their course experiences in the instructional process.
2. Course training is not considered insufficient for the four techniques.
3. Teachers are furnishing most of their own materials for the preparation of visual materials requiring the graphic techniques that are taught in the course, but administrators would approve the purchase of these materials upon teacher request.
4. Audio-visual directors or coordinators are not becoming involved in the production of graphic materials.
5. Adequate physical facilities have not been provided for local production, but administrators would make space available if an organized program were established in their schools.
6. Mounted flat pictures, posters, and charts rank high in the types of visual materials prepared for classroom use.
7. A knowledge of the graphic techniques helps in the presentation of subject matter, increases the variety of materials used, and aids the understanding of subject areas.
8. Teacher produced materials are as important as commercially prepared materials.
9. Administrators are not well informed concerning the area of teacher-production, but are willing to cooperate in a program that will benefit their teachers.
10. The course, Preparation of Inexpensive Instructional Materials, is effectively contributing to the teaching process through greater knowledge, improved skill, and better understanding of instruction.

Major Recommendations

1. School administrators should become better informed concerning local production.
2. Audio-visual educators must provide helpful information and direction if local production programs are to be initiated in the public schools.
3. Teachers must have common training experiences

for functional production programs. Purposeful production should be based upon careful evaluation on the part of the teacher.

4. Teachers should develop broad concepts concerning the production and use of graphic materials. They should become involved in learning outcomes rather than mere production processes.

5. Production programs should be contained within individual schools in order to realize the greatest benefits to teachers.

6. A central production area should be provided in each school so that teachers have access to an organized environment.

275 pages. $3.55. Mic 57-160

TEACHER ROLE PERCEPTION IN COLLEGES AND UNIVERSITIES

(Publication No. 19,899)

Persis Hamilton Cowan, Ed.D.
Stanford University, 1956

Statement of the Problem

This is a study of teachers' roles as perceived by academic and education faculty in ten colleges and universities preparing teachers in the Bay Area. It is the responsibility of the institution for teacher education to see that the teacher is prepared for competent performance of all his duties. The areas of required expertness have been outlined in the California definition of Teacher Competence.[1]

The present study is one of a series to determine the viewpoints of various groups regarding roles of the teacher, and to identify discrepencies between theory and practice. A comparison between two faculty groups, Academic and Education, is made, and analysis of the relationship of role perception to age of the faculty, to professional experience, to experience in higher education, and to experience in public schools.

Procedures

Interviews and questionnaires were used, supplemented by related institutional materials. Faculty from the following areas participated: Psychological Foundations; Sociological Foundations; three academic departments representing courses required for credentials; Elementary, Secondary Methods; Elementary and Secondary Student Teaching.

Two questionnaires were used, referred to as Test A and Test B. The instruments, constructed from behavioral items under each teaching role in Measure of a Good Teacher, were used by Fishburn.[2] His findings on administrators and teachers were compared.

Treatment of Data

Two techniques of analysis were followed. The Correlated Means Formula was used to show the significance of differences in absolute scores.[3] Where percentage scores were computed, differences between independent proportions were determined by the schema described by Nelson.[4]

Conclusions

Conclusion 1: In the interviews, academic and professional staff recognized the importance of the six teacher roles. The majority mentioned the roles of Director of Instruction and Counsellor and Guidance Worker, as most important.

The order of role importance on rank average computation follows: Role 4, Mediator of the Culture; Role 1, Director of Instruction; Role 3, Member of the School Organization; Role 2, The Teacher as Counsellor and Guidance Worker; Role 6, Member of the Profession; Role 5, Link with the Community.

Conclusions 2, 3, and 4: The factors of age of the instructor, years of professional experience, and experience in higher education had some effect on Role Perception. Faculty perceived roles in the light of their own experience, and present responsibility. There was less concern for roles outside the classroom.

Conclusion 5: Public School experience was not an important factor in Role Perception.

Conclusion 6: There was a great deal of similarity between academic and education staff in Teacher Role Perception.

Conclusion 7: Since most of the roles were recognized in the interviews, each role may be considered important. A greater number of academic faculty perceived relatedness of the roles.

Recommendations;

This study having direct bearing on the program of teacher education, recommends:

1. Staff growth through study and analysis of the teachers responsibilities.
2. Staff use of methods the individual will use in assuming the teacher's roles.
3. Foundation courses in Sociology and the School in the American Scene should provide experiences leading to understanding the community.
4. Psychology and Guidance should provide for individual and group study of public school students.
5. Courses in parent relations should be instituted.
6. Student teaching programs organized so that each role is learned.
7. Follow-up programs should be instituted by the colleges to insure success of new teachers.
8. Institutions in other areas should make comparable studies.

1. Kinney, Lucien, Measure of a Good Teacher, California Teachers Association, San Francisco, 1953

2. Fishburn, Clarence, "Teacher Role Perception in a Single Community," (Unpublished Ed. D. Dissertation, School of Education, Stanford University, 1953).

3. McNemar, Quinn, Psychological Statistics (New York: John Wiley and Sons, 1955) p. 108.

4. Nelson, Denny, Coladarci, Statistics for Teachers (New York: Dryden Press, 1956) p. 60.

119 pages. $1.50. Mic 57-161

AN ANALYSIS OF CERTAIN SELECTED FACTORS CHARACTERISTIC OF STUDENTS WHO SUCCEEDED IN TEACHER EDUCATION AT BALL STATE TEACHERS COLLEGE

(Publication No. 19,268)

Ralph Robert Cummings, Ed.D.
Indiana University, 1956

Problem. To determine whether the characteristics of students ranking highest in the criteria of success are significantly different from the characteristics of students ranking lowest.

Procedure. The population was a selected group of students in the secondary education curriculum who succeeded in completing teacher education and graduated from a teachers college. The measured criteria of success were academic achievement, peer-social acceptance, self-adjustment, and critic teacher rating. The upper 27 per cent was compared with the lower 27 per cent of the population, distributed according to each criterion of success. Each of the success criteria was used as a variable for the other criteria. The variables were grades earned in the professional courses, ratings by the supervisors, scores on the sophomore English test, reasons for choosing the teaching profession, and the time when the decision was made to become a teacher. The chi square and Student's t-test were used to analyze the data for differences between the two groups. The differences were tested at the one and five per cent levels of confidence.

Conclusions

The conclusions presented below were based upon the findings obtained from the analysis of the data involved in the investigation. The upper 27 per cent of the students were compared with the lower 27 per cent when distributed according to each criterion of success for the variables under consideration.

1. The success criteria, grade-point ratio, self-adjustment, and critic teacher rating, distributed according to peer-social acceptance, did not appear to distinguish between the upper 27 per cent and the lower 27 per cent of the distribution.
2. The continuous variables, distributed according to peer-social acceptance, did not appear to distinguish between the upper 27 per cent and lower 27 per cent of the distribution. The continuous variables analyzed were the methods courses, practice teaching, professional courses, supervisor's rating, and English proficiency.
3. It appeared that the lower 27 per cent of the distribution according to grade-point ratio may have had a tendency to be more accepted by their peers than the upper 27 per cent of the distribution.
4. The upper 27 per cent of the distribution according to grade-point ratio had a tendency to receive higher ratings by the critic teacher than the lower 27 per cent of the distribution.
5. The upper 27 per cent of the distribution according to grade-point ratio was not distinguished from the lower 27 per cent of the distribution by self-adjustment.
6. The upper 27 per cent of the distribution according to grade-point ratio had a tendency to be superior in methods courses, practice teaching, professional courses, supervisor's rating and English proficiency.
7. It appeared that the upper 27 per cent was not differentiated from the lower 27 per cent when they were distributed according to self-adjustment for any of the variables analyzed.
8. Those in the most successful group in the critic teacher ratings tended to be more accepted by their peers and received a higher grade-point ratio than those in the least successful group.
9. The most successful group in critic teacher rating did not seem to be distinguished from the least successful group by the methods courses, English proficiency, or self-adjustment.
10. The reasons for deciding to become a teacher and the time when the decision was made were not distinguishing factors between the upper 27 per cent and the lower 27 per cent when they were distributed according to the success criteria. 144 pages. $1.90. Mic 57-162

ANALYSIS OF FIFTY INSTRUCTIONAL PROBLEMS OF ELEMENTARY SCHOOL STAFFS IN THE STATE OF IDAHO AND THE IMPLICATIONS FOR IN-SERVICE GROWTH PROGRAMS

(Publication No. 17,503)

Delva Daines, Ed.D.
State College of Washington, 1956

This study attempted to survey and analyze fifty instructional problems of the elementary school staffs in the state of Idaho and the implications for in-service growth programs. The survey instrument was sent to all elementary school teachers, elementary school principals, supervisors and superintendents in the state.

An attempt was made to determine what, in the opinion of these teachers, were the problems most important to study for curriculum improvement, and if there were sufficient problems of common concern to serve as a basis for a statewide in-service growth program.

Administrators were asked to select what they believed the teachers were most interested in studying for curriculum improvement and what they believed the teachers needed most to study.

The method or methods for in-service growth programs the teachers and administrators had participated in and preferred were analyzed. Also analyzed was the background data concerning the respondents to determine if there were any implications for in-service growth programs in the state of Idaho.

In analyzing the responses of the teachers and administrators the following seemed to be significant:

1. The teachers throughout the state of Idaho selected similar problems most important in their opinion to study for curriculum improvement.
2. The selected problems were closely related and were concerned with developing a better understanding of the individual needs of children and ways of providing for these needs of adjustment and learning in the classroom, and the techniques of teaching independent reading skills to children. This is shown by the five problems the teachers selected as most important, which are listed in order of choice.

(a) Providing for the needs of slow learners.
(b) Providing for the needs of fast learners.
(c) Understanding the needs of children with behavior problems.
(d) Developing skills for independent work attack at the different reading levels.
(e) Developing the feeling of confidence, security and belongingness in children.

3. The fact that these teachers have given significance to the same problems for study indicated it is possible and desirable for in-service growth programs to be planned on a statewide basis in Idaho.

4. Administrators were unable to determine in identical order all of the same problems which the teachers considered to be most important for study.

5. The workshop was selected as the most preferred method for in-service growth programs.

6. Sufficient background data concerning the respondents was obtained to aid in the planning of in-service growth programs.

The results indicated it is essential to provide teachers with the opportunity to designate the problems in which they are most interested in studying for curriculum improvement. This is necessary because the administrators were unable to judge all of the same instructional problems the teachers considered to be most important to study. Results also indicated that there were sufficient problems of common concern to the teachers in Idaho to serve as a basis for planning an interrelated statewide in-service growth program. 189 pages. $2.50. Mic 57-163

A PROPOSED TRAINING PROGRAM FOR INDIAN SCHOOL COUNSELORS

(Publication No. 20,010)

Indu Dave, Ed.D.
University of Georgia, 1956

Supervisor: James E. Greene

The present study was planned with the specific purpose of proposing a training program for the education of Indian counselors. The proposed training program was planned to be implemented in the Vidya Bhawan Govindram Seksaria Teachers College, Udaipur, Rajasthan, India. At the same time, the general applicability of the program to many teacher-educational institutions of India was kept in view.

The methods of investigation employed in the study were historical and philosophical. The sources of data used in the planning of the program were from two countries: (1) India, and (2) The United States of America. Authentic Indian literature was investigated for the purpose of analysing the conditions and needs of Indian society. The job-analysis of a counselor's work was done on the basis of American professional literature. Ideas about the actual training program which was to be developed in the Indian educational field were derived from the study of American literature on guidance and counseling and the author's personal experience in American educational institutions.

The procedure used in the planning of the study was as follows. A general orientation to India was given to familiarize a foreign reader with various peculiarities of the country for which the proposed program was to be planned. An analytic view at Indian education pointed out the specific deficiencies in the Indian educational field and the causes of those deficiencies. Guidance implications of the current Indian scene were examined in order to establish the validity of the present study. The sociological needs which demanded counselor-training programs in India led to an appreciation of the philosophical fundamentals on which such programs could be based. In order to make the proposed program practicable, it was decided to start it in one particular institution with which the author was familiar. This decision led to a detailed examination of the locale of the proposed training program. Discussions up to this stage established the socio-philosophical bases of the proposed training program.

The actual planning of the training program involved the following steps. The job of a counselor was analysed with a view to determining (a) the functions which need to be performed by a counselor, and (b) the competencies of the counselor implied by the functions which he performs. A knowledge of the competencies made it possible to devise and describe the kinds of educational experiences required to help the counselor attain those competencies. These educational experiences formed the proposed training program.

The originality of the project lies in adapting the knowledge and experience gained in America to the Indian situation. An analysis of the Indian educational field also revealed that the training program specifically planned for one Indian institution could, with local modifications, be adapted to many teacher-education institutions of India. The conclusions indicate that the basic principles governing the life and education of different nations or different parts of the same nation are not very different from each other. A clear understanding of these principles, and a vivid perception of the local needs and conditions often makes pertinent adaptations possible.

303 pages. $3.90. Mic 57-164

THE USE OF THE MINNESOTA TEACHER ATTITUDE INVENTORY IN THE SELECTION, COUNSELING, AND PLACEMENT OF STUDENT TEACHERS

(Publication No. 17,155)

W. Maxine Gray, Ed.D.
Wayne University, 1956

Adviser: Charlotte W. Junge

I. INTRODUCTION

Statement of the Purpose. The major purpose of this study was to evaluate the effectiveness of the Minnesota Teacher Attitude Inventory as an additional procedure in selection, placement, and counseling of students beginning their student teaching experiences. A further purpose was to relate the information secured from the Inventory to data secured from students' admission applications and success in their student teaching experiences.

Five questions were identified for study.

A. To what extent, as revealed by the Minnesota Teacher Attitude Inventory do the students to be studied possess desirable teacher attitudes toward children and school work?

B. What relationship exists between scores on the Inventory and success in student teaching, as evidenced by the supervising teachers' rating of the students?

C. What characteristics and behaviors identified from the Minnesota Teacher Attitude Inventory correlate with student success or weakness as indicated by data secured from the students' admission applications and work experiences with children prior to student teaching?

D. What relationship exists between success or weakness in student teaching and scholastic achievement?

E. To what extent do a selected group of students succeed in student teaching as evidenced by the investigator's evaluation of the student's teaching and from conferences with him?

II. SOURCES OF DATA

One hundred twenty-one second semester students in the Department of Elementary Education at Wayne University were involved in the beginning of this study. By the end of the semester, one hundred fourteen remained. These students were enrolled in the regular four-year curriculum leading to the bachelor's degree and certification.

Results of the Inventory administered to these students, information compiled from admission applications and the Evaluation Form For Reporting Progress in Student Teaching served as sources of data for use in this study.

A stratified randomly selected group of students was selected for observation by the investigator.

III. METHODS OF COLLECTING AND ANALYZING DATA

Early in the fall of 1955 the Minnesota Teacher Attitude Inventory was administered to all regular four-year second semester junior students.

Correlations between scores on the Inventory, honor-point average, grade in student teaching, and ratings on the American Council on Education Psychological Examination for College Freshmen were made. A multiple correlation was also determined using the above mentioned variables.

Strength of relationships involving factors of age, honor-point, sex, marital status, and previous experience with children was determined by use of the phi coefficient and checked against the chi square statistic.

Relationship between the reasons students gave for entering the teaching profession and honor-point average was made by use of chi square.

Evaluation of the quality of work of the stratified randomly selected group was made by the investigator. Her observations were verified by two other qualified observers.

IV. CONCLUSIONS AND IMPLICATIONS

No predictive correlation appeared to exist between the Minnesota Teacher Attitude Inventory and any of the other measures used in this investigation.

The average grade received by students involved in this study as a result of one semester of student teaching experience appeared to be "B."

Students placed in a student teaching experience with supervising teachers judged to be excellent teachers of children and extremely helpful to students appeared to grow in confidence, ability, and independence.

It appears that no one method is adequate to be used as a basis for predicting success in student teaching. A combination of methods both subjective and objective in nature is needed and should be used.

The multiple correlation involving the four variables of: (1) the Inventory, (2) Psychological Examination, (3) honor-point average, and (4) grade in student teaching; yielded a formula whereby the student's grade in student teaching could be predicted within .5 of an honor point.

249 pages. $3.25. Mic 57-165

A STUDY OF THE ATTITUDES OF CLASSROOM TEACHERS TOWARD EXCEPTIONAL CHILDREN

(Publication No. 19,378)

Norris Grover Haring, Ed.D.
Syracuse University, 1956

Introduction

The attitudes and understanding that teachers have about exceptional children influence the intellectual, social and emotional development of these children. Teachers who have adequate understanding of the nature of exceptionality and a knowledge of the special instructional techniques and methods are potentially more capable in their teaching relationships with exceptional children. In addition, teachers who are capable of accepting exceptional children without uneasiness or pity are believed to be more capable of providing an atmosphere of acceptance within the classroom which may be reflected in the attitudes of the children.

Purpose of This Study

The purpose of this study was:

1. to determine the extent to which the attitudes of classroom teachers can be modified toward greater and more realistic acceptance of exceptional children,
2. to attempt to modify the initial attitudes of these teachers by the utilization of a workshop concerned with exceptional children.

Procedures

The data were collected from all of the teachers and administrators in the following four schools located in or near the Syracuse, New York area:

1. Seymour School (a city elementary school in Syracuse)
2. Cherry Road School (a common school district in the town of Geddes)
3. Union Springs Centralized School (an elementary and secondary centralized school district in Union Springs)

4. St. John the Evangelist (a Catholic parochial, elementary and secondary school in Syracuse)

The personnel in the four schools were presented fifteen identical workshops which met every other week over a period of approximately thirty weeks. Each meeting lasted two hours. During the first hour the teachers were given a lecture in a particular area of the exceptional child. For the second hour, the teachers divided into small pre-arranged discussion groups led by discussion leaders.

Pre- and post-testing were conducted during the first and last sessions of the workshop. The battery of tests included four tests designed to measure knowledge of exceptional children, acceptance of exceptional children, and the personality characteristics of the teachers. A critical incident technique was used to determine the extent to which the teachers utilized the knowledge and increased acceptance they gained from the workshop in their teaching relationships with exceptional children. A subjective analysis of the tape recordings of the discussion groups were done to note the changes in the nature of the discussions throughout the workshop.

Results

1. The workshop proved highly effective in increasing the information and understanding that the teachers had concerning children with exceptionalities.
2. Wide differences existed throughout the four schools in the modification of attitudes toward greater acceptance of exceptional children. The teachers from Seymour and Union Springs schools showed significant increases in acceptance; however, the change in acceptance demonstrated by Cherry Road and St. John the Evangelist schools was not significant. The two schools that became significantly more accepting toward exceptional children had by far the greatest number of exceptional children in the classrooms.
3. The workshop was not effective in increasing the abilities of teachers to become more realistic about the placement of children with exceptionalities.
4. There were no consistent patterns of change in the personality structure of the teachers from the four schools. Seymour and Union Springs schools expressed the greatest receptiveness to the workshop. Disregarding any modification which may have occurred between the pre- and post-testing, the teachers were an unusually reserved group. They were particularly restricted in the expression of personal needs.
5. On the dimension positivity-negativity, the teachers, as a total group, became significantly more positive in their responses to pictures of handicapped children. No significant changes occurred among the teachers on this dimension toward themselves or toward other individuals.
6. As assessed by the Critical Incident Technique, the workshop was found to have had a strong positive influence upon the attitudes, philosophy, and teaching methods of the teachers which carried over into their teaching relationships with exceptional children.
7. A subjective analysis of the tape recordings revealed that the teachers from Seymour and Union Springs schools were able to express feelings and attitudes with greater freedom. Cherry Road and St. John the Evangelist schools seemed restricted in their expressions and resorted to direct questioning of the discussion leaders.

Conclusions

Teachers presented with formal lectures supported by permissive discussion sessions, films and visits to classrooms in which exceptional children are being educated increased their knowledge concerning exceptional children irrespective of their having direct experiences with these children. However, increased knowledge per se is not a significant factor in affecting modifications of teachers' attitudes toward exceptional children. Having classroom experiences with exceptional children concurrent with a workshop seems to play a crucial role in the effectiveness of programs designed to influence teacher attitudes toward these children. 290 pages. $3.75. Mic 57-166

AN ANALYSIS OF THE OPINIONS OF INDIANA SECONDARY SOCIAL STUDIES TEACHERS CONCERNING THE FIFTH YEAR OF TEACHER EDUCATION

(Publication No. 19,273)

Ernest W. Horn, Ed.D.
Indiana University, 1956

Chairman: Howard T. Batchelder

The purposes of this study were to obtain the opinions of Indiana secondary social studies teachers concerning the adequacies and inadequacies in the fifth year of teacher education and to derive conclusions from the findings which would aid graduate schools in curriculum revision for the improvement of the fifth year in teacher education.

An interview guide was developed which emphasized the following problem areas in the fifty year of teacher education: (1) provision for content of the various social science areas; (2) provision for professional education offerings; and (3) administrative practices, policies, and procedures governing the fifth year of teacher education.

Personal interviews were held with 44 randomly selected teachers who possessed the master's degree and taught solely social studies courses in Indiana North Central Association schools during the first semester of the 1955-1956 school year. The chi square test was then applied to the data to determine significant differences, if any, in the responses of the teachers in terms of number of years teaching experience, type of master's degree, date the master's degree was conferred, and whether a teacher had taken or had not taken certain courses.

Conclusions

From the findings in this investigation based primarily on the felt needs of teachers, the following major conclusions were drawn:

1. The fifth-year program for teachers of social studies should be planned as a continuation of the first four years of teacher education and should include further

study at the graduate level in the social science subject-matter field and in professional education; there should be opportunities for the strengthening of cultural background through travel study and/or general education courses.

2. In the fifth-year graduate program social science courses in the areas of American history, European and other history, government, economics, sociology, and geography should be provided.

3. The following professional offerings should be provided in the fifth year of teacher education for social studies teachers: advanced social science methods; the development of skills in the supervision and direction of social science laboratories; the resolving of curriculum problems and the selecting and organizing of curriculum materials and experiences; principles of individual and group guidance; in-service training for the study of local school problems; adult education; advanced student teaching and observation; adolescent growth and development; a professional basic area in the tools and techniques of research which would include work in tests and measurements, research, and statistics; and a professional area in the theory of education which would include educational sociology and the study of the role of the school and society.

4. The fifth year should provide for introductory social science courses which offer graduate credit, without prerequisites, and designed especially for social studies teachers lacking a basic background in a specific area.

5. Some of the more desirable characteristics of the fifth year in teacher education for social studies teachers seem to include the provision for an instructional staff whose members have had continuous experience with young people and who use a variety of teaching methods. Adequate audio-visual, curriculum, and laboratory facilities should be provided; also laboratory schools should be available to provide demonstration and experimentation as well as to give teachers a place where they can apply and extend their professional competence through directed experience with young people. The students should be provided the opportunity to select formal social science courses and to conduct research projects in the social science areas. The program should be flexible to meet individual needs and should lead to a master's degree.

176 pages. $2.30. Mic 57-167

A STUDY OF THE GUIDANCE IMPLICATIONS OF PSYCHOLOGICAL REPORTS IN THE PUBLIC SCHOOLS

(Publication No. 17,770)

Owen Bert Keene, Ed.D.
Indiana University, 1956

The purpose of the study was to investigate certain specific areas of counseling, namely, the use of the school psychologist as part of the counseling program and their relationship with the school guidance program. Secondly, the study was concerned with certain characteristics of psychological reports and their value to teachers and principals as an evaluation of specific difficulties which pupil referrals presented in a variety of school situations.

The design of the study utilized the collection of case-study reports from the five psychological centers in the Indianapolis public schools. These were categorized into certain problem areas, namely, academic, behavior and emotional, retardation, superior students, and requests for information. These cases totaled 668 usable psychological reports. The second step involved constructing and sending out two questionnaires to respondents. These respondents included 80 principals, 235 teachers, and five psychologists. Returns were obtained from 62 principals, 143 teachers, and five psychologists. The major information obtained from the teacher and principals respondents included (1) general background information, (2) opinions as to the value of psychological reports, (3) adaptations that the respondents made in the school program and curriculum, (4) factors preventing follow through of psychological recommendations, (5) results obtained in following psychological recommendations, (6) difficulties experienced concerning the psychological service, (7) observation of the reaction of parents to psychological recommendations, and (8) difficulties experienced with parents with regard to the psychological service. The information obtained from the psychologists included the frequency and amount of school follow-up of psychological recommendations, and the type and comparative frequency of cases that came to their attention. The data collected from respondents was computed and statistical analyses made of all data collected from teachers, principals, and school psychologists.

An analysis of the data presented revealed certain findings and conclusions:

1. The preponderance of cases were found at the elementary school level. This included a total of 97 per cent of the cases found at the grades kindergarten through grade eight.

2. Academic and retardation problems made up 60 per cent of the total number of cases categorized.

3. It was found that the principals and teachers thought that the psychological reports were of value to them in their work with pupil referrals.

4. The principals and teachers were able to effect changes in the school program, as recommended by the psychological recommendations, except where conditions existed that prevented follow-up of recommendations.

5. The principals and teachers felt that over-crowded classrooms, inadequate facilities, and the home environment of the referrals were the most important factors in preventing follow through of psychological recommendations.

6. With regard to the psychological service, the principals and teachers indicated they needed help in working effectively with the psychologists, setting up case conferences with persons involved with the referral, planning activities for the referrals, and securing appropriate materials, and understanding causes of psychological manifestations.

7. Both the principals and teachers noted that the parents were highly cooperative and seldom, if ever, rejected any suggestion or recommendations. When difficulty occurred, it often was misunderstanding due to lack of knowledge concerning the psychological service.

8. In comparing between the principal's and teacher's reaction to the psychological service, it was found that both groups were in agreement on nearly all of the major areas.

9. Concerning the psychologist's opinion as to the

school's follow-up of psychological recommendations, the psychologist felt that the schools were following up most of the recommendations in all areas listed and that the environment of the referrals tended to be the most frequent cause in preventing the school follow-up of psychological recommendations.

Certain conclusions were drawn from the findings in this study. They are as follows:

1. Since only three per cent of the cases were found at the secondary school level, it is concluded that an increase or addition to the psychological services is necessary in order to avoid the neglect of pupil referrals at this level.

2. The large percentage of academic and retardation problems places an over emphasis on the slow learner to the detriment of those with superior ability or with severe adjustment problems. Since the time of the psychologist is extremely limited this over emphasis becomes important.

3. Provisions are necessary to allow for greater flexibility of the school program, particularly at the elementary level, in order to provide for a more complete adaptation for psychological referrals.

4. Considerable study should be given to the problems of over-crowded classrooms, undesirable home environment, and inadequate facilities in order to aid in the alleviation of these difficulties causing disruption of the psychological follow-ups of pupil referrals.

5. Since the parents were found to be highly cooperative, the psychological service should be frequently explained to new parents in order that continued success may be realized in this area. 208 pages. $2.70. Mic 57-168

DIRECT EXPERIENCES IN COLLEGE BIOLOGY FOR PROSPECTIVE ELEMENTARY TEACHERS IN THE MIDWEST (PARTS I AND II)

(Publication No. 18,309)

Pauline Louise Sauer, Ph.D.
Cornell University, 1956

Chairman: Eva L. Gordon

This study deals with one facet of the preparation of prospective elementary teachers in college biology, that of direct experiences. The term "direct experiences" as used here applies only to those experiences involving actual materials or phenomena in which students participate actively and personally.

Three surveys were conducted to ascertain how well state and municipal teachers colleges in midwestern United States are preparing students for the types of biology experiences they are likely to encounter in their elementary school teaching. An attempt was made to determine (1) the direct experiences provided by these colleges in the general biology courses required of their four-year elementary majors; (2) the direct experiences suggested by science education authorities in their methods books; and (3) the direct experiences described in recommended elementary school science guides. College biology courses were surveyed through questionnaires, catalogs, and correspondence; books and science guides by personal examination.

These surveys revealed the following trends: 1. In all three sources there is a wide variety of subject matter and in experiences used to develop it. 2. All, especially the college courses, encourage microscopic studies. 3. Elementary schools, more than most colleges, emphasize (a) local and seasonal materials, (b) living (rather than preserved) materials, (c) outdoor experiences, (d) simple equipment, (e) correlation with daily experiences.

The foregoing studies indicate that college biology programs for prospective elementary teachers might be developed more effectively along the following lines: 1. The subject matter background should be broad in scope. 2. Laboratory and field experiences are vital and should emphasize (a) use of local and seasonal materials, (b) study of living (rather than preserved) materials, (c) outdoor experiences , (d) variety of experiences with specific subject matter items, (e) correlation with daily life, (f) simple equipment, (g) development of resourcefulness in problem solving.

By comparing published college biology laboratory manuals with the needs implied by the findings of the above surveys, their value for prospective elementary school teachers was ascertained. Their greatest contributions appear to be the development of: a broad background of information; the scientific method; laboratory experiences; and microscopic studies. Their greatest deficiences relate to: variety of experiences; field experiences; use of local and seasonal materials; use of simple equipment; and familiarity with biological literature.

Inasmuch as published biology laboratory manuals seem inadequate for the preparation of prospective elementary teachers, a suggested program of college biology laboratory and field experiences is proposed. The conclusions drawn from the surveys form the basis for this program. After establishing a set of criteria for including experiences, a list of objectives for a college biology laboratory program, and a list of major concepts to be developed in such a course, the suggested program is briefly outlined. A few representative exercises are then presented in detail to illustrate types of procedure and materials that appear useful in the college preparation of prospective elementary teachers.

Throughout the suggested program emphasis is on actual experience and personal observations. However, to supplement and reenforce these direct experiences students are referred to authoritative teacher and accurate pupil references.

The suggested program, based on the needs implied by the surveys, is planned to develop in students a broader background of information on the fundamentals of biology, the spirit of investigation, and resourcefulness and competency in teaching elementary school science.

372 pages. $4.75. Mic 57-169

THE RELATIONSHIP OF VARIOUS FACTORS TO ACHIEVEMENT IN INDUSTRIAL ARTS STUDENT TEACHING

(Publication No. 19,789)

John Atwood Storm, Ed.D.
Cornell University, 1956

The Problem

This study was directed towards learning the causes, antecedents, and factors related to achievement in industrial arts student teaching.

The Procedure

With greatly contrasting levels of achievement in student teaching constituting the basis for selection, two groups of thirty each were isolated from the total 445 industrial arts student teachers at Teachers College, Oswego, New York, during the 1951-1956 academic years.

Student teaching in this program occurred in the sixth or seventh semesters of an eight semester curriculum. It was a twenty week experience divided into two halves with the student teacher spending each half in a different student teaching center. These centers were distributed on a state wide basis and the program was supervised by a college staff which also shared on campus teaching responsibilities.

Data for the study were secured from: (1) records at the college, (2) master teachers' quantitative ratings, (3) qualitative reports by the master teachers, (4) qualitative reports by college supervisors, and (5) replies from a questionnaire to these student teachers.

Findings

1. Failure to satisfy requirements in terms of written reports was the greatest single cause of low achievement.
2. The mean grade earned for: . (a) "teaching ability," and (b) "knowledge of subject matter" was slightly below the mean grade for "student teaching" by both groups.
3. The mean grade for "ability to care for the physical and human aspects in industrial arts student teaching" was slightly above the mean grade for student teaching by both groups.
4. The specific ability most frequently lacking in both high and low achievers was "skill in communications."
5. A high degree of relationship exists between leadership ability, affiliation with professional activities, age, marital status, military experience, and high achievement in student teaching.
6. Correlations between achievement in student teaching and academic achievement ranged from r equals -.01 (mathematics, low group) to r equals .49 (English, high group).
7. A pleasing personality was a factor related to high achievement.
8. High and low achievers considered directed observation a most worthwhile adjunct to their student teaching experiences.
9. Both groups considered their reports attendant to directed observation of questionable value.

Conclusions

1. More opportunity for teaching should be provided students prior to assignment to student teaching.
2. Education classes should be conducted in an education laboratory, not in the conventional classroom. Facilities should be available in this education laboratory for demonstration teaching by the students.
3. A unit of study directly concerned with student teaching should be included in at least one pre student teaching education course. It should make clear the duties, responsibilities, and accountability of student teachers.
4. Students should experience more industrial arts activities prior to assignment. Depth in a few shop areas should be replaced by a broader experience in all shops.
5. All college staff members should work towards improving their students' communication skills.
6. More experiences which would tend to eliminate the indifference, presently noted in student teachers, towards fulfilling obligations should be provided in the pre student teaching curriculum.
7. Directions governing reports required from student teachers should be clear, result in no duplication of effort, manifest value, and place a judicious demand upon their time.
8. Frequent meetings between college staff and other personnel participating in a student teaching program are necessary to establish uniform policy and control.
9. College staff, working in a student teaching program which operates on a state wide basis, cannot adequately supervise and teach on campus concurrently. Supervision and teaching should rotate on a "semester basis."
10. The process of evaluation used in student teaching should be critically reviewed to make certain that achievement depends upon accomplishment directly akin to the avowed purposes of student teaching.

177 pages. $2.35. Mic 57-170

AN EVALUATION OF THE BUSINESS EDUCATION PROGRAM AT SOUTHWESTERN STATE COLLEGE

(Publication No. 19,502)

William Wedekind Ward, Ed.D.
The University of Oklahoma, 1956

Supervisor: Gerald A. Porter

This study constitutes an attempt to determine the effectiveness of the program of business education offered at Southwestern State College, Weatherford, Oklahoma. The problem consists of two parts: (1) a critical departmental self-evaluation by the members of the faculty of the Department of Business Education, and (2) a follow-up survey of the effectiveness of business education as reported by former students. The study concerns the effectiveness of the curricula in business education and the total subject matter offering of the Department of Business Education.

The data for this investigation were obtained primarily from the 10 members of the faculty of the Department and 444 former students who attended the College between September, 1945 and August, 1954. The information on which this study is based was given subjectively and pertains to eight aspects of business education: (1) structure of the program, (2) curriculum patterns, (3) professional laboratory experiences, (4) library, (5) physical layout and equipment, (6) preparation of the faculty, (7) teaching load

of the faculty, and (8) student personnel services. A comprehensive departmental self-evaluation schedule and student follow-up questionnaire were utilized in collecting the data. The findings resulting from the self-evaluation and student evaluation procedures are so extensive that they cannot be adequately summarized here.

The conclusions reached in this study are summarized:

1. The organizational structure and administrative practices affecting the program of business education at Southwestern State College are, in general, satisfactory. Increased expenditures for equipment and supplies to be utilized in instruction would have a salutary effect upon the program.

2. Comprehensive and carefully formulated statements of objectives of the program of business education do not exist.

3. As a result of study in the various curricula offered by the Department of Business Education, individuals encounter little or no difficulty in obtaining satisfactory employment in business occupations and business teaching positions. However, the effectiveness of certain specific required and elective subjects taken by business education students may be questioned. In the future, at least six semester hours of economics should be required in all business education curricula.

4. The extent of the participation of business students in extra-class activities is limited.

5. Library acquisitions pertaining to business education have been adequate only since 1950.

6. The amount of space and the general characteristics of the classrooms and offices utilized by the Department are adequate. Immediate steps should be taken to install adequate storage facilities in the classrooms and offices. Additional electric typewriters, calculating machines, transcribing equipment, and duplicating equipment should be acquired for instructional purposes.

7. In terms of academic knowledge, experience, and professional attitude the faculty of the Department appears to be adequately prepared. The instructional ability of the faculty as a whole is respected by former students. The effectiveness of the program of business education could be increased if individual teaching loads were reduced.

8. The personal relationships maintained between students and advisers in counseling and guidance are good. More extensive standards involving academic achievement and personal characteristics should be developed and applied in recruitment, retention, and placement circumstances.

9. The evidence collected indicates that, in general, in the opinions of faculty and former students alike, the program of business education at Southwestern State College is extremely effective. As is true of all educational programs, major and minor elements of strength and weakness exist. The elements of strength and weakness have been isolated in this study so that appropriate steps can be taken to ensure continued growth and development of the over-all business education program.

257 pages. $3.35. Mic 57-171

EDUCATION, THEORY AND PRACTICE

A STUDY OF THE INTERRELATIONSHIP BETWEEN GROUP GUIDANCE AND SUBJECT MATTER AS REPORTED BY SELECTED SECONDARY SCHOOLS

(Publication No. 17,499)

Claude Douglas Babcock, Ed.D.
State College of Washington, 1956

This study has reported the responses made by representatives of fifty selected schools to a data gathering instrument designed to reveal a number of things about a school which attempts to integrate guidance materials and methods with regular classroom work. The instrument contained questions on philosophy, pattern of organization and operation, problems met and solved and those remaining to be solved, and respondents' opinion of the value, in terms of pupil growth, of the program attempted. The instrument was constructed upon basic assumptions found to be common to the two fields of curriculum development and guidance. It was perfected by means of six trials with revisions to eliminate ambiguity.

It was found that authorities in curriculum development and in guidance were in agreement upon the basic aim of American education – the preservation and extension of the democratic way of life. They were in further agreement that the means whereby such an aim may be achieved is through the observation of three tenets of democracy – (1) respect for the individual, his interests, needs, and abilities, (2) recognition of the need for socializing the individual to give opportunity for his optimal development, and (3) the use of the method of critical thinking for solving individual and group problems. Authorities agreed that to educate young people to live in a democracy, education must, itself, be democratic. A considerable amount of evidence was presented to support the idea that the fields of curriculum development and guidance need to be more closely related in order to individualize instruction and thus improve learning. This study of fifty schools presents a picture of the way in which these schools have attacked this problem, the common patterns of organization and operation, the extent to which they agree with authorities concerning educational philosophy, common problems encountered in the development, and their opinion of their success with their experiment.

The pattern of operation in these schools suggest that the integration of guidance with subject matter classes may occur in any class in any department, but English and the social studies have attempted it most often. The classes are open to all regardless of ability or interests. Textbooks are common, but the teacher operates from resource unit type plans and as a democratic leader of a group. No line separates guidance concepts from course content, and the aims of the class, developed and evaluated cooperatively, are expressed in terms of problem-solving understandings, and practice in democratic living.

The study has shown that the fifty schools agree wholeheartedly with the philosophy of the authorities. It has also indicated that the programs described by the respondents are implementing that philosophy to a considerable extent. The schools are entirely consistent in their effort to teach their young people about democracy and to provide opportunity for them to practice living that way.

The respondents to the data gathering instrument indicate several problems which still require better solutions than they have found. Materials and methods for evaluating the work of these classes are lacking. Trained personnel who understand the democratic group processes are much needed. Administrators and general public need to be given better understanding of this type of program. These problems suggest the need for further research in the areas of evaluative techniques, public relations, and teacher pre-service and in-service training.

In spite of the obvious problems to be solved, the people who are working with the integration of guidance techniques and materials with regular subject matter classes are agreed that they believe the integration to be the most successful method that they have found to teach young people the skills, attitudes, and appreciations which are needed by all citizens of a democracy.

103 pages. $1.50. Mic 57-172

A STUDY OF THREE APPROACHES TO THE CORRECTION OF FUNCTIONAL CONSONANT DEVIATIONS IN GRADES TWO, THREE, AND FOUR

(Publication No. 19,062)

Elsie M. Edwards, Ed.D.
Wayne University, 1956

Adviser: Charlotte Junge

This study was concerned with evaluating three approaches to the correction of functional consonant deviations in the speech of second, third, and fourth grade children. The approaches were: A, an integrated program carried on by the classroom teacher; B, speech improvement program for the entire room; and C, speech correction instruction for small groups of children which included those with functional consonant deviation. The B and C programs were carried on by the speech correctionists.

Subjects were drawn from thirty randomly selected classrooms in ten schools. A speech survey in all rooms screened out the children with acceptable speech. Speech tests administered by the experimenter and two correctionists eliminated all speech defects of organic origin. The children selected as subjects were in grades two, three, and four, ages six through ten, and they exhibited functional consonant deviations. Two speech correctionists assisted the experimenter in the testing. Ten classroom teachers and three correctionists participated in the instructional program.

The procedure in the study was: (1) pre-experimental testing; (2) putting the experiments in operation; (3) post-experimental testing.

Instructional materials for approaches A and B were supplied by the experimenter. In approach C, they were compiled by the correctionists.

The research design was a series of parallel experiments in randomly selected classrooms in ten schools. The criterion measure was the mean percentage gain (based on the pre-test and post-test). Analysis of covariance, employed to analyze the total data, was used to remove initial differences that might be reflected in the pre-test so that the actual percentage gain resulting from the experience might be measured. The hypothesis tested and supported was: There is no difference (corrected by linear regression) among approaches.

In a restricted sample from the total data, the analysis was the Latin square design with analysis of covariance. The following hypotheses were tested and supported:

There is no difference in mean percentage gain:
(1) among approaches; (2) among schools; (3) among grades; and, (4) there is no interaction among approaches, schools, and grades. (In all cases, mean percentage gain corrected by linear regression for initial number of errors.)

The results of the experiments led to conclusions which are applicable only to the situation described above. Limitations in the research design restrict the scope of the findings and the extent to which generalizations may be drawn. Within these limitations, the following conclusions were drawn:

(1) All approaches to the correction of functional consonant deviations might be used to extend speech training.
(2) Grades two and three appeared to profit more in approaches A and C while the fourth grade profited in approach A and B.

Conclusions in terms of practical implications were:

(1) The expansion of speech training can be accomplished through the cooperation of all staff members.
(2) Classroom teachers, supported by correctionists, are willing and capable of helping children with functional consonant deviations.
(3) Speech improvement, taught in the classroom by the speech correctionists, takes too much time from cases with serious disorders.
(4) Teacher training institution should provide speech courses to help future teachers and in-service teachers to assume their responsibility in the total speech program.

The results of this study indicate the need for further research evaluating instructional approaches in the elementary school speech program. Research designs based on random sampling should be restricted and controlled to facilitate statistical computations. Wider generalizations might be drawn from the findings of these designs.

201 pages. $2.65. Mic 57-173

CAREERS OF GUIDANCE MAJORS AT THE MASTER OF ARTS LEVEL, STANFORD UNIVERSITY

(Publication No. 19,902)

Murl James Gibson, Ed.D.
Stanford University, 1956

The basic purpose of this study was to determine the extent to which guidance training at the master of arts level at Stanford University during the years 1947-1953 meets the criterion of preparing graduates for "successful" employment in the field of guidance. "Successful" in this study means that the graduate entered the field of guidance work and remains in the field. In general, this investigation of a sample of guidance majors sought

answers to the following broad questions: (1) To what extent have the graduates actually found employment in the guidance field? (2) To what extent do they feel they have been adequately prepared for the tasks and responsibilities they have encountered in their jobs? (3) What suggestions or recommendations do these graduates have for the revision of Stanford's guidance training program at the master's level?

The basic findings of this study were based upon the questionnaire responses of 94 graduates who were granted the master's degree with guidance as their field of concentration during the years 1947-1953. During this period, some 125 guidance majors were granted the master's degree. Questionnaires were mailed directly to 113 of the graduates for whom correct addresses could be located. Ninety-four completed questionnaires were returned – a return of some 83 per cent.

In order to collect relevant data regarding the professional lives of the graduates being studied, an eight page follow-up questionnaire was constructed. Major attention was focused upon the following broad areas: (1) educational background, (2) credentials held, (3) employment history, (4) job analysis, (5) job satisfaction, (6) areas of guidance competencies, (7) areas of professional inadequacies, (8) appraisal of master's program in guidance, and (9) strengths, limitations, and suggestions. The questionnaire consisted of structured and "open-end" questions. The questionnaire, while not tested for reliability, was improved through administration to small groups followed up by interview and through submission to other research workers for criticism.

Since the problem involved exploration and extensive data collection, rather than the testing of preformulated hypotheses, methods of analyses employed included tabulation, category formation, and inductive reasoning. Quantifiable data taken from the structured items of the questionnaire were presented, wherever appropriate, in terms of percentages, means, medians, and other important findings. Opinion data, wherever feasible, were categorized and also presented descriptively.

In general, the data obtained from this large proportion (approximately 70 per cent) of M. A. graduates in the guidance field indicate that these Stanford trained people have obtained employment and continue in guidance work in schools and colleges throughout the country. These graduates continue to be reasonably well satisfied with the training they received. They tend to place high value on the breadth of preparation for work in the education field which characterizes the Stanford program. This finding gives general support to the faculty's continued emphasis on the foundational fields in education.

In their area of specialization, the graduates felt generally competent to deal with the range of problems presented by normal students. They also presented candid criticisms of program deficiencies in certain special aspects of counselor training. These deficiencies were primarily in the area of psychodiagnostics and practicum training. The need for experience in applying theory and techniques, for supervised counseling practice was most strongly emphasized. Mention was also made of the need for physical facilities for interviewing, observation, and individual testing facilities. The general approval expressed implies that the basic guidance training program at Stanford University is meeting an educational need and should be maintained. The deficiencies noted led to certain recommendations for change. 168 pages. $2.20. Mic 57-174

CONSTRUCTION AND VALIDATION OF A FILM SLIDE TEST TO MEASURE ABILITY TO APPLY SCIENTIFIC METHOD IN A SELECTED AREA OF HIGH SCHOOL PHYSICS

(Publication No. 19,625)

Harvey John Goehring, Jr., Ph.D.
University of Pittsburgh, 1956

The Problem of the Study

The problem was to construct and determine the reliability and the validity of a film slide test designed to measure ability to apply scientific method in the area of mechanics in high school physics. The problem was delimited to (a) the construction of a visual test based upon color film slides, (b) a study of eleventh- and/or twelfth-grade pupils who had studied at least one semester of physics and (c) a selected sample of the secondary schools of Allegheny County, Pennsylvania, which offered a one-year course in physics.

The Method of Procedure

The method employed was the survey testing method of research. The following procedure was used: Principles of mechanics which had been found to be essential to general education in high school physics were selected as the basis for the visual test. Based upon 47 of these principles, 35-millimeter color film slides were constructed. From 358 such slides, 107 film slides to be included in the original film slide test items were selected on the basis of the effectiveness of the slide in illustrating a specific principle of mechanics.

Thirty-six aspects of scientific method (elements of problem-solving behavior) were selected on the basis of their general acceptance by foremost authorities in the field of education and of science. Based upon the 107 film slides, 101 written test items were prepared for the purpose of requiring reasoning of a kind necessary to demonstrate ability to apply to the physical phases of everyday situations those aspects of scientific method which had been selected. Thirteen judges with a mean of 11.77 years of experience teaching physics on both the high school and college levels were selected by random sampling to rate each test item and a manual of directions for the administration of the test. Twenty-seven test items were selected for inclusion in the preliminary tryout test of scientific method on the basis of the merit ratings of the test items by the judges. A synchronized sound (tape) recording was prepared to present orally the problem situation and the question relating to each film slide.

In order to determine the understanding of each pupil of the principle of mechanics involved in each test item, a written test of principles of mechanics was prepared. After revision, this test was composed of 26 items.

Both tests were administered to a sample of 412 pupils, each pupil receiving an orientation sheet on the day before the test was administered. The film slide test questions were of the multiple-choice type. The problem was presented by the projected film slides and by the tape recorder. The test items for the final film slide tryout test were selected on the basis of an item analysis of the preliminary film slide tryout test. The final film slide tryout test contained 24 items and the revised form of the principles of mechanics test contained 20 items. Both tests were administered to a random sample of 761 pupils.

The Findings of the Study

The coefficients of reliability of the preliminary tryout test and the final tryout test of scientific method were, respectively, 0.75 and 0.94. The theoretical maximum reliabilities of which the preliminary and the final tryout tests were capable were, respectively, 0.86 and 0.97.

The Conclusions

It is feasible to measure effectively through the media of projected film slides, written answer sheets, and synchronized sound recordings, the ability to apply a scientific method of thinking in the area of mechanics in high school physics. Both the preliminary tryout test and the final tryout test of scientific method, as constructed and used in this study, are instruments which possess a satisfactory degree of reliability and validity for practical classroom use. 243 pages. $3.15. Mic 57-175

AMERICAN VALUES AND "PROGRESSIVE" CURRICULUM WRITERS

(Publication No. 19,903)

Wayne Orlando Hill, Ed.D.
Stanford University, 1956

Statement of the Problem: Many educators have argued that the American public schools are unwilling to accept and apply many of the practices and philosophies of "progressive" education. To locate what may be primary causes for this reluctance to accept progressive education, this study compared the values expressed in the writings of selected "progressive" leaders in elementary curriculum with a list of values for the American culture. The purpose of this comparison was to determine to what extent the values presented in the curriculum writings of these selected "progressive" curriculum specialists are congruent, or in conflict with, the values social scientists say are held by the wider American public. From the results of this comparison, it was possible to describe those areas of the progressive education program, as represented by selected curriculum specialists, which are acceptable or unacceptable to the broader American public.

Procedures: The value orientations for the American culture represent a consensus of interpretative judgments by social scientists who have published materials on this subject. The value orientations are described as: Change and progress, Success and Achievement, Practicality and Efficiency, Moral Orientation, Sociability and External Conformity, and Democratic Ideology.

"Progressive" education is characterized as a child-centered, needs, or emergent curriculum. L. Thomas Hopkins, Alice Miel, Carleton Washburne, and Florence Stratemeyer were selected as representative of this point of view. The four curriculum specialists' collected writings were examined to determine what values they held in relation to the dominant American value orientations. It was not only necessary to note the values actually expressed, but also to infer from recommended practices the values which formed the base of their recommendations.

A consensus of abstracted values representing the curriculum specialists were compared, value by value, with the values social scientists say are held by the American public.

Results: Comparisons between the American value orientations and the values of the four curriculum specialists produced the following areas of agreement. Both value patterns: (1) agree that change and progress are desirable; (2) have faith in the use of science and its methodology; (3) respect the intrinsic worth of each individual; (4) expect that individuals should know how to relate to others, and in general, conform to peer standards; (5) believe in individual freedom from arbitrary restraint and control; and (6) maintain equality of opportunity.

Progressive educators conflict with American values over: (1) the amount and kind of planning needed to achieve desirable human goals; (2) whether education is preparation for present or future living; (3) what constitutes successful achievement; (4) what is practical and efficient achievement and what means can legitimately be used; (5) the extent to which science and its methodology are applied to all areas of human life; (6) the morality of failure; and (7) altruistic attitudes toward others.

Conclusions: It has been found that agreements and conflicts exist between American values and the values of selected progressive educators. The areas of agreement should form the point of departure for any reconciliation between American values and those of progressive educators. It will be necessary for progressive educators to modify their views so that the areas of conflict do not hamper the education of children. In general, however, it is felt that the position of progressive education can be measurably strengthened through an understanding of the areas of conflict and areas of agreement.

208 pages. $2.70. Mic 57-176

AN ANALYSIS OF THE NUMBERS AND SOURCES OF CRYING INCIDENTS OF CERTAIN GROUPS OF KINDERGARTEN CHILDREN

(Publication No. 19,719)

Genevieve Bergetta Syverson, Ph.D.
University of Michigan, 1956

The problem of this study was to investigate the crying behavior of kindergarten children. Within this broad framework of reference the following areas were considered: the changes that occurred in the numbers of crying incidents during the year, the general and specific sources of crying, the presence of race differences or similarities in crying behavior, the presence of sex differences or similarities in crying behavior, the changes in the numbers per source of crying incidents during the year.

The data for the dissertation were collected by observing four kindergartens. Visitations were divided into two periods – before and after Christmas. Visitations were made weekly in three kindergartens for thirty weeks, and daily in one kindergarten for the same time period. Experienced teachers and student teachers were used as observers. Check lists were used as recording devices. Records were kept on one hundred five children, ranging in age at the mid-point of the study from sixty to seventy-eight months.

The following data on each child were used in the analyses: birth date, sex, race, kindergarten membership, number, length and sources of crying incidents, minutes

of observing time and crying time. Data were ordered into the following groups for analyses: Negroes, Whites, boys, girls, Negro boys, white boys, Negro girls and white girls.

For each group, means and standard deviations were figured for the ratios of crying time to observing time, and the average length of crying time. These figures were subjected to the "t" test for the equality of means and the "F" test for the homogeneity of variables.

The percentages of the total crying incidents for each group per period were figured. A test was applied to the data to determine whether or not the number of crying incidents occurring in either period differed significantly from fifty per cent. A test was also applied to determine whether or not percentages between two groups for two periods differed significantly.

The crying incidents were classified by sources as recorded. The percentages of total crying incidents by source for each group per period were figured. These data were analyzed to determine whether or not the number of crying incidents occurring in either period differed significantly from fifty per cent.

The four leading general sources of crying incidents were separated. Confidence limits at the one per cent level were calculated. The same procedure was followed for the four leading specific sources.

The following conclusions were drawn about this sample group: few differences were established between the means of the ratios of crying time to observing time or average length of crying time; significantly more than fifty per cent of the total number of crying incidents occurred during the first period; no differences were established in the percentages of two groups for the two periods; assaults was the general leading source of crying incidents for all groups for all periods; the general sources were almost identical between groups. Order of importance changed slightly between groups. Assaults by peers was the leading specific source in all groups. More similarities than differences existed in sources between groups. Again, differences were in relative importance of sources, rather than in the sources themselves.

This study brings into focus two implications for education. The crying behavior originating in self and/or peer action is not especially damaging, and hence, not subject to immediacy or necessity of change. Conversely, the crying produced by non-peer action, particularly when the source is separation from family, task failure and teacher interference, is symptomatic of a developing nonproductive attitude toward education. Consequently, the sources which produce this behavior should be removed from the environment. 142 pages. $1.90. Mic 57-177

ENGINEERING, GENERAL

CERTAIN CONCEPTS OF OPERATIONS DESIGN

(Publication No. 19,774)

Joseph William Gavett, Ph.D.
Cornell University, 1956

As a basic function executed in a formal organization, design is defined as the conception, creating, development, selection, arrangement, and combining of the physical elements of various systems. This function is differentiated from other basic functions such as programming, control, evaluation, and operational. These functions are implemented by individuals or groups within an organization structure although their execution does not rest exclusively with specific and independent groups.

The function of design is discussed from the viewpoint of design of the operation. The operation is defined as a composite of elements of work, control, and communications systems although the discussion is confined to the work system. The assignment of manual work elements to people, or operators, is defined as a problem of job design. The process is defined as an aggregate system of operations and jobs. Throughout the thesis emphasis is placed on the problem of relating operations, during the stages of design, to the larger systems of which they are a segment.

The function of design is described in the following terms:

1. The application of a methodological process including a number of major phases, viz.
   a. the formulation of immediate objectives and the selection of criteria for evaluating alternatives. This includes the problem of maintaining a compatibility between immediate objectives and high level objectives of the organization as a whole.
   b. the analysis of restrictions, marginal restrictions, and factors of the problem using both static and dynamic models.
   c. the synthesis of factors and marginal restrictions into alternative designs.
   d. the selection among derived alternatives in terms of the specified outcomes as well as the probability of changes in the outcome of critical parameters.
2. The execution of a multi-stage design process resulting in the evolution of an approximated idea into a completed detailed design with a set of specifications for future action. Such a process includes approximating, intermediate and detailed design stages carried out by a given designer or various groups in both a horizontal and hierarchial organization structure.

The objective of these processes is to derive an effective and optimal operation design. Effectiveness is related to a creatively synthesized structure while optimality is related to synthesis by a logical-analytical quantitative procedure.

The formalization of stages and phases in an administrative plan of design is dependent on the scope of the problem and its complexity. The greater the scope and complexity as measured principally by the magnitude of the resources to be expended in the operation the greater the possible formality and attention devoted to the function of design, its stages and phases. But even in problems of immediacy or those dealing with elementary work systems the effectiveness of a course of future action depends on the application of the design function. In these events, stages and phases, while not ostensible, may be implicit in the designer's methodology of planning a method of work leading to an effective design.

In the formal organization there are restrictions and limitations imposed on a design problem. There are restrictions on the values or dimensions that may be assigned to factors, the variables of the operation design problem. Certain variables of a given design problem are jointly interacting, in a critical sense, with variables in other design problems or with elements of an existing system. These variables are marginal restrictions and are designable by mutual agreement between different groups in an organization.

There are also limitations in design resources applicable to a given problem. These are related to the allocation of design resources to specific problems as well as to the manner in which designers are organized.

167 pages. $2.20. Mic 57-178

ENGINEERING, AGRICULTURAL

A DETERMINATION OF THE RETARDANCE COEFFICIENTS OF OPEN CHANNELS IN VOLUSIA SOIL OF NEW YORK STATE

(Publication No. 19,783)

Juanito Lino Ordoveza, Ph.D.
Cornell University, 1956

In Southern New York standard designs which limit diversion channel gradients to about 1 % are impractical in the extremely rolling topography of this region. Conservation engineers in this area have expressed the need of design data for proper channel design and stabilization. This research was aimed at the determination of the hydraulic design characteristics for Volusia soil found dominant in the Southern Tier Counties of New York State.

Manning's velocity formula $V = \frac{1.486}{n} R^{2/3} S^{1/2}$ where R is the hydraulic radius, S is the slope and n is the roughness coefficient, is universally used in channel design. This formula assumes uniform flow conditions, where, under steady flow in any channel length, the average velocity at every cross-section is the same. Actual flow in open drainage channels is usually nonuniform.

Manning's formula, however, is still used and has presented reasonable results. Based on this assumption, measurements were made of the experimental channel cross-section and of the depths of flow to obtain calculated values of the roughness coefficient.

Channels one-hundred feet long with twenty-five feet of entrance length, fifty feet of experimental length, and twenty-five feet of exit length were used; a rectangular cross-section, one foot wide was maintained. Channels on five grades - 2 %, 4 %, 6 %, 8 %, and 10 % were studied. Two channels were built per slope topsoil and subsoil. To determine the erosive velocities through the channels and the effect of flow on n, comparative measurements of the water depth, channel bed and rates of flow were made for the topsoil and subsoil channels. Cross-sections of the channels were observed before, during, and after each test run. The experimental section was divided into five stations, ten feet apart. Channel and water depths were measured at each of these stations.

A summary of the calculated roughness coefficient is presented considering three possible assumptions. One: n = 0.026, obtained under the assumption that the roughness coefficient was equal for both the channel bed and the side steel plates. Two: n = 0.031, obtained under the assumption that the roughness coefficient was different for the channel bed and for the side steel plates. Here, a correction for the effect of the steel side plates was made. Three: n = 0.034, obtained when the depth of water was used as the hydraulic radius in the evaluation of the roughness coefficient. Under this assumption, the side steel plates were assumed to have negligible effect as compared to the turbulent effects of the eroded channel bottom. These values, a result of a first attempt in their determination, may be considered as Manning's equivalent roughness coefficient values.

It was also found that for Volusia soil, excessive erosion occurs at slopes of 6 %, 8 %, and 10 % under peak flows with velocities about five feet per second and lasting for twenty minutes. It appears that unless vegetation and other structures to prevent excessive scour are provided, slopes greater than 4 % should be avoided by the designer when working on bare Volusia soil.

146 pages. $1.95. Mic 57-179

ENGINEERING, AERONAUTICAL

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE INITIAL WAVE PHENOMENA IN A WEAK SPHERICAL BLAST

(Publication No. 19,505)

R. Gordon Campbell, Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professor: Dr. J. V. Foa

The spherical wave phenomena studied in this dissertation are the initial waves created by the sudden release of a spherical volume of compressed air in a limitless environment of air at constant state. The works of other investigators on various aspects of the general problems of the formation, propagation and decay of spherical blast waves are reviewed briefly and it is found that for only one case, that of a particular, powerful blast, is there available in the literature a complete analytical solution with corroborating experimental data for the early stages of the blast.

In 1954 H. Schardin reported the results of ingenious experiments conducted in France on the specific blast case for which F. Wecken had previously (1952) completed a numerical solution for the initial behavior of the blast using the method of characteristics. Schardin's results corroborate the existence and position in time and space of the second, inwardly propagating shock wave first discovered by Wecken shortly after starting his numerical solution. Other authors have subsequently studied the second or inner shock formation analytically and have shown that it begins to form at the instant of origin of the blast wave and that it grows in strength rapidly thereafter.

The present investigation includes the application, believed to be the first, of the principle of the shock tube for obtaining measurements of the pressure variation within the compressed gas and in the immediate environment of the spherical blast during the initial stages. The construction of a pyramidal shock tube, the technique developed for rupturing the diaphragm satisfactorily and the associated data recording techniques are described. The primary objectives of the research are to provide further understanding of the inner shock phenomenon and corroborative experimental data and to obtain at least preliminary evidence on the utility of the shock tube for spherical blast measurements.

The method of characteristics has been utilized to obtain first a numerical solution for the initial stages of the specific, weak, spherical blast case investigated experimentally. It is shown that the inner shock forms, propagates in to the center and reflects in the case of a weak blast just as Wecken found for the powerful blast case.

The experimental data provide excellent corroboration of the existence and position in time and space of the inner and reflected shocks as was obtained in Schardin's experiments. The quantitative agreement between the computed and experimental data is fair except near the center behind the reflected inner shock where the measured pressures were appreciably less than the computed values. In general, the results obtained provide encouraging evidence that the conical or pyramidal shock tube is a valuable laboratory device for further study of spherical blast phenomena.

The numerical solutions by characteristics, obtained without the use of electronic computing equipment, was started in the fall of 1953 and was completed in the spring of 1955 at which time the blast measurements were also completed.

133 pages. $1.80. Mic 57-180

A STUDY OF FLOW ABOUT OBJECTS TRAVELING AT HIGH SUPERSONIC SPEEDS

(Publication No. 19,922)

Alfred John Eggers, Jr., Ph.D.
Stanford University, 1956

A method of characteristics for solving two- and three-dimensional steady and non-steady supersonic flow

problems is developed and discussed. An approximate method, termed the generalized shock-expansion method, applicable at high supersonic speeds is developed and considered in some detail.

The two-dimensional flow about curved airfoils is investigated analytically with these methods at high supersonic airspeeds assuming air behaves first as an ideal, and then as a calorically imperfect gas. For ideal gas flows it is shown that the shock-expansion method predicts pressure distributions which are at most in only a few percent error at arbitrarily high or, as they are sometimes termed, hypersonic Mach numbers, provided the flow deflection angles are at least one degree less than those for shock detachment. Forms of the shock-expansion method and the method of characteristics, generalized to consider the caloric imperfections of air and applicable for local air temperatures up to 5000 degrees Rankine, are obtained and investigated. This shock-expansion method also exhibits a wide range of applicability. A high Mach number approximation to both shock-expansion methods is investigated and presented in a form for ready application to engineering problems. This method is termed a slender airfoil method and it predicts pressure coefficients with less than 10-percent error at Mach numbers greater than 3 and flow deflections up to 25 degrees.

Axially symmetric flow about bodies of revolution is also studied in some detail. Using the generalized shock-expansion method, explicit expressions are developed which yield with good accuracy the local Mach number and pressure distributions on the surface of such bodies operating at high supersonic airspeeds and at values of the hypersonic similarity parameter (ratio of free-stream Mach number to slenderness ratio) greater than 1. Very simple explicit expressions are obtained for these distributions in the special case of slender bodies. In the case of cones, the analytic solutions accurately define the entire flow field over a wide range of free-stream Mach numbers and apex angles.

Finally, several three-dimensional flow fields, including those about oblique airfoils, inclined bodies of revolution and oscillating airfoils are discussed briefly. Particular attention is paid to the application of the generalized shock-expansion method, and it is concluded from these and the previous considerations that this method, by virtue of its simplicity and accuracy, can largely replace the characteristics method for calculating hypersonic air flows. 141 pages. $1.90. Mic 57-181

ON THE INSTABILITY OF SMALL GAS BUBBLES MOVING UNIFORMLY IN VARIOUS LIQUIDS

(Publication No. 20,018)

Richard Aram Hartunian, Ph.D.
Cornell University, 1956

The instability of small gas bubbles moving uniformly in various liquids is investigated experimentally and theoretically.

The experiments consist of the measurement of the size and terminal velocity of bubbles at the threshold of instability in various liquids, together with physical properties of the liquids. The results of the experiments indicate the existence of a universal stability curve. The nature of this curve strongly suggests that there are two separate criteria for predicting the onset of instability, viz., a critical Reynolds Number (202) and a critical Weber Number (1.26). The former criterion appears to be valid for bubbles moving uniformly in liquids containing impurities and in the somewhat more viscous liquids, whereas the latter criterion is for bubbles moving in pure, relatively inviscid liquids.

The theoretical analysis is directed towards an investigation of the possibility of the interaction of surface tension and hydrodynamic pressure leading to unstable motions of the bubble, i.e., the existence of a critical Weber Number. Accordingly, the theoretical model assumes the form of a general perturbation in shape of a deformable sphere translating uniformly in an inviscid, incompressible fluid medium of infinite extent. The calculations lead to divergent solutions above a certain Weber Number, indicating, at least qualitatively, that the interaction of surface tension and hydrodynamic pressure can result in instabilities of the bubble motion.

However, a subsequent investigation of the time-independent equations shows the presence of large deformations in shape of the bubble prior to the onset of unstable motion, which is not compatible with the approximation of perturbing an essentially spherical bubble. This deformation and its possible effects on the stability calculation are therefore determined by approximate methods. From this, it is concluded that the deformation of the bubble serves to introduce quantitative, but not qualitative, changes in the stability calculation.

117 pages. $1.50. Mic 57-182

AN EXPERIMENTAL INVESTIGATION OF THE STABILITY OF AXIALLY SYMMETRIC POISEUILLE FLOW

(Publication No. 19,706)

Richard Joseph Leite, Ph.D.
University of Michigan, 1956

The purpose of this experimental study was to investigate the stability of Poiseuille flow and compare the experimental results with the theoretical predictions of a recent unpublished mathematical analysis of the problem by Corcos and Sellars. A review of this theory is presented and experimental results are compared with its predictions.

Hot-wire anemometer measurements were made in fully developed laminar flow in a smooth lucite pipe having an internal diameter of 1.25 inches and a length of 73 feet at Reynolds numbers of 4,000, 6,600 and 13,000. Small, nearly axially symmetric disturbances were superimposed upon the mean flow by longitudinal oscillations of a sleeve immediately adjacent to the inner wall of the pipe. The frequency and amplitude of this motion could be continuously controlled over a suitable range of values. Radial traverses of the disturbed flow field gave amplitude and relative phase angle variations across the pipe while longitudinal surveys provided means of computing wave velocities and damping factors of the disturbances. Results of several typical radial, peripheral and longitudinal

surveys are presented. These surveys indicate that the disturbance does not achieve complete equilibrium before it is completely damped. Nonaxial symmetry of the disturbances is interpreted as a superposition of axially and nonaxially symmetric components. Measurements indicate that the nonaxially symmetric components decay at least as rapidly as axially symmetric disturbances.

Some brief observations of the effects of large disturbances are presented also. The fact that the onset of turbulent flow is not an instantaneous phenomenon appears to be a rather significant result of these observations. Large disturbances appear to undergo a systematic distortion as an intermediate step in the establishment of the fully turbulent state. When a turbulent wake was introduced at a mid-radial position, initially the wake diffused radially with little effect in the velocity profile. At a distance of 47 diameters downstream both the turbulence distribution and the velocity profile were near those for fully developed turbulent flow.

Several general conclusions can be drawn from this experimental investigation: 1) Poiseuille flow is stable when perturbed by small axially symmetric or nonaxially symmetric disturbances within the Reynolds number range investigated, 2) the rate of decay and speed of propagation of disturbances are in satisfactory agreement with theory, and 3) the onset of turbulent flow in fully developed laminar pipe flow, when large disturbances are imposed, is not an instantaneous phenomenon but one that takes place through a relatively regular process of growth and diffusion of the disturbance. 90 pages. $1.50. Mic 57-183

ON THE "TRIPLE POINT" IN SHOCK-DIFFRACTION PROBLEMS

(Publication No. 19,790)

Tien-Fun Sun, Ph.D.
Cornell University, 1956

When a plane straight shock advances toward and then is diffracted by an infinitely long wedge, there is a nearly circular diffracted wave originating from the edge and interacting with the incident or the reflected shock. The purpose of the present study is to determine the flow inside the diffracted wave, the position and the strength of the diffracted wave and in particular how it reinforces or attenuates the incident or the reflected shock at the points — "triple points" — where it intersects them.

Only weak incident shocks with Mach number $Ms \equiv 1+\epsilon$ are considered, where ϵ is a small quantity and is used as a measure of orders of magnitude. The flow is assumed irrotational and isentropic. The flow field is "time-space" conical and a reduced velocity potential $f(r,\theta)$ exists, where r, θ are the conical coordinates. By the usual conservation laws a complete differential equation for $f(r,\theta)$ is arrived at. Following Lighthill's "technique for rendering approximate solutions to physical problems uniformly valid," one expands both the dependent variable f and the independent variables r, θ into new variables F, R, ϑ, i.e.,

$$f(r,\theta) = F(R,\vartheta) = F(R,\vartheta) + F_2(R,\vartheta) + \cdots\cdots$$
$$r = R + r_1(\vartheta) + r_2(\vartheta) + \cdots\cdots$$
$$\theta = \vartheta$$

The first approximation F_1 is the same as the classical linearized solution. It has a square-root singularity at $R = 1$ and, in addition, due to the discontinuous boundary conditions, a singularity of pole type at the triple point. The expansion formula of the independent variable, say $r_1(\vartheta)$, is then so determined that the order of the singularity at $R = 1$ does not grow in subsequent approximations. When the linearized solution is transformed back to the r, θ — plane, by physical reasoning and interpretation, one is able to determine the character and the position of the diffracted wave. However, no success has been achieved in treating the pole singularity at the triple point, even by a more generalized expansion of r, θ.

In order to remove the pole singularity, a transition function is introduced in the R, ϑ plane to connect the discontinuous boundary values. As the pressure and velocity components are related by some compatibility relations, only one transition function is required for each triple point. $F_1(R,\vartheta)$ is then expressed in terms of $g(\vartheta)$. It is transformed back to r, θ — plane. In the triple-point region, which is of $o(\epsilon)$ in radial direction and of $o(\epsilon^{\frac{1}{2}})$ anglewise, the leading term of $f(r,\theta)$ is found to be of $o(\epsilon^2)$ and the rate of change of physical quantities along the radial direction is of $o(\epsilon^{-1})$ and that along the angular direction of $o(\epsilon^{-\frac{1}{2}})$. These orders of magnitude are uniformly correct in the triple-point region. However, it seems that the subsequent approximations, e.g., $F_2(R,\vartheta)$, $r_2(\vartheta)$, may also make contributions to the first-order solution.

Nevertheless, the contributions of $F_2(R,\vartheta)$, etc., to the first-order approximation are assumed to be numerically small. As a semiempirical approach to find the shock position, etc., one may neglect them and use only $F_1(R,\vartheta)$ and $r_1(\vartheta)$. By the tangential and normal shock conditions a set of simultaneous non-linear, integro-differential equations governing the transition function and the shock position is obtained. A numerical solution based on polynomial approximation to the unknowns is carried out. The agreement between the theoretical values and the experimental data is fairly good. 127 pages. $1.70. Mic 57-184

ENGINEERING, CHEMICAL

THE REDUCTION OF TUNGSTEN OXIDES: EFFECT OF PELLET DENSITY AND INERT GAS ON THE RATE OF REDUCTION WITH HYDROGEN

(Publication No. 19,511)

Gene G. Mannella, Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professor; Professor J. O. Hougen

An investigation of the rate of reduction of pelletized tungsten oxides has been undertaken. The rate data obtained were for the temperature interval 700-850°C. The study has covered the effect of hydrogen-inert mixtures on the rate of reduction of both WO_3 and WO_2, and the effect of pellet density on the rate of reduction of WO_3 with pure hydrogen. In addition, an investigation into the identity of the phase known as β-tungsten has been carried out.

The results show that the rate of reduction of both WO_3 and WO_2 is sensitive to the molecular weight of the

inert gas accompanying the hydrogen. The pellet density also effects the rate of reduction of WO_3 with pure hydrogen. From the data it appears that the mechanism may involve two diffusion processes; one associated with diffusion through the pellet, the other with diffusion through the particles which make up the pellet.

It was also demonstrated that the material known as β-tungsten is not a low oxide of the metal, such as W_3O. This material appears to be a low-temperature modification of tungsten metal and any oxide which might be present acts as an impurity and does not influence the x-ray pattern.

106 pages. $1.50. Mic 57-185

HEAT TRANSFER AND FLUID DYNAMICS IN MERCURY - WATER SPRAY COLUMNS

(Publication No. 18,638)

Robert Dean Pierce, Ph.D.
University of Michigan, 1955

This study was undertaken to extend the available liquid-liquid spray column transfer data to a system with a liquid metal phase and to investigate fluid dynamics in spray columns. One- and two-inch diameter glass columns were operated spraying mercury at approximately 205°F into rising streams of water. Two column lengths, 13-1/4" and 19-3/8", and twelve mercury dispersing nozzles were employed. The nozzles are 1/4" plates drilled with from one to 113 holes, ranging from 0.189" to 0.016" in diameter.

Mercury flow rates between 4 and 33 lbs/min and water flow rates from 0.2 to 0.6 gal/min were used. Water temperatures were measured throughout the columns and mercury temperatures were measured before dispersion and after coalescence. Ten of the nozzles, with holes less than 0.075" in diameter, produced sprays with uniform drop sizes ranging from 0.024" to 0.10" in diameter, but the two nozzles with larger holes produced irregular drop sizes. Mean drop velocities at zero water rate varied between 1.4 and 2.9 ft/sec for the drops smaller than 0.10". A range of volumetric holdups between 0.3 and 10% and specific areas between 2.5 and 250 sq. ft. of mercury surface/cu.ft. of column were investigated.

Steady state heat transfer coefficients were calculated using logarithmic mean temperature differences based on the temperature differences at the top and the bottom of the columns. These coefficients ranged from 125 to 1500 Btu/(hr)(sq. ft. of mercury surface)(°F) at Reynolds numbers between 350 and 3500.

A discontinuous rise in the water temperature at the bottom of the columns prevented the outlet mercury temperatures from approaching the inlet water temperatures as a limit. This sharp rise in the water temperature, which was as much as 80% of the total rise in water temperature, was caused by recirculation of the water phase. High speed motion pictures of the movement of dye in the columns showed that the principal upward flow of water bypassed the mercury drops while the water surrounding the falling drops flowed downward. These pictures showed very little horizontal mixing between these countercurrent water streams. The temperature discontinuities were the same in the 13-1/4" and 19-3/8" columns which also indicates that the horizontal mixing between the streams was slight. Three heat transfer results indicate that the major heat transfer resistance was not at the mercury water interface but between the water surrounding the drops and the bypassing water stream: (1) heat transfer coefficients were lower than would be expected based on results for transfer of heat from fixed spheres to flowing water, (2) variations in heat transfer were less than would be expected for corresponding variations in drop surface area, and (3) heat transfer coefficients decreased with increased column lengths which would be expected if a large portion of the total transfer occurred at the column ends where the mixing was more complete. Modifications in column design and column diameter did not produce detectable effects on the heat transfer coefficients.

The liquid-liquid spray column study differs from other studies because of the large differences between the densities and thermal conductivities of the phases and because of the greater attention to fluid dynamics. The results permit an increased understanding of the flow patterns and transfer mechanisms in spray columns and also provide a basis for evaluating spray columns for liquid metal-fused salt systems.

200 pages. $2.60. Mic 57-186

ION EXCLUSION EQUILIBRIA FOR GLYCEROL, SODIUM CHLORIDE, WATER, AND DOWEX-50 WITH APPLICATION TO CONTINUOUS COLUMN DESIGN

(Publication No. 19,717)

Edward Lytle Shurts, Ph.D.
University of Michigan, 1955

In Ion Exclusion an ion exchange resin is used as a fractionating medium to separate electrolytes from non-electrolytes in polar solvents. A quantitative knowledge of the equilibrium distribution of components between the resin phase and the external phase which surrounds the resin is vital to an understanding of Ion Exclusion. Up to the present, distribution data of this type have been unavailable.

Consequently, equilibrium data for the typical system glycerol, sodium chloride, water, and Dowex 50 x 8.7, an ion exchange resin, were measured in this investigation with glycerol concentration ranging from 2 to 46 weight percent and sodium chloride concentration from 3 to 26 weight percent between 24 and 26°C. These data may be correlated as:

$$Y_G = 0.5687\,X_G + 0.004472\,X_G^2 + 0.023023\,X_G X_S - 0.000113\,X_G^2 X_S + 0.000661\,X_G^{0.5} X_S^2$$

and

$$Y_S = 0.0286\,X_S + 0.01408\,X_S^2 + 0.0001102\,X_G X_S^2$$

where X_G, X_S = weight percent of glycerol and sodium chloride in the external phase, respectively,

and Y_G, Y_S = weight percent of glycerol and sodium chloride in the resin phase on a resin-free basis, respectively.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

with a standard residual error of ± 0.15 weight percent for glycerol and ± 0.07 for sodium chloride.

The resin phase was analysed by a technique in which the weight of any component in the resin phase is determined by subtracting the weight of that component in the external solution from its initial weight in the equilibrium cell. This technique requires precise measurements of the swelling characteristics of the resin, the initial inventory of the equilibrium cell, and analysis of the external equilibrium solution. The swelling characteristics of the resin were determined by diameter measurements of spherical particles under a microscope, and by pycnometer measurements of the deviations from the law of additive volumes. Glycerol was analysed in the ternary solutions with a precision of ± 0.04 weight percent by a procedure involving density data which were measured and correlated for that purpose.

The thermodynamics of ion exclusion is reviewed but does not serve to correlate the data since fundamental knowledge of activity coefficients in concentrated solutions or the osmotic pressure in the resin phase is not available.

A design method is developed to predict the operation of a continuous ion exclusion column. It is based upon the equilibrium stage concept in which the column is divided into finite increments or stages. The number of theoretical stages necessary for a given separation can be calculated by assuming that the resin and liquid leaving each stage are in equilibrium. A sample design is presented in which the column not only separates the non-electrolyte from the electrolyte but also concentrates the former in the product.

The equilibrium data and design method are used to analyze operating data taken from a continuous ion exclusion column. The column is known as the "pulsed-bed" type since the resin moves up the column in periodic pulses. The height equivalent to a theoretical stage under typical conditions for either glycerol or sodium chloride is found to be on the order of two or three inches. The column operation is shown to be restricted to a narrow range of relative flow rates.

128 pages. $1.70. Mic 57-187

THE EFFECT OF CONCENTRATION LEVEL ON MASS TRANSFER RATES

(Publication No. 19,726)

Lawrence Edward Westkaemper, Ph.D.
University of Michigan, 1956

Mass transfer rate data were taken for the evaporation of carbon tetrachloride into air-carbon tetrachloride mixtures. A parallel plate geometry was used. Liquid carbon tetrachloride was evaporated from a plane surface in the bottom of a rectangular duct into a turbulent gas stream passing through the duct.

The cross section for air flow in the duct was 5/8 inch by 4-1/16 inch, and the length of the test section was 48 inches. The liquid being evaporated flowed into the bottom of the duct through a perforated plate and overflowed at weirs at each end of the test section. Inlet liquid was preheated to maintain the desired liquid temperature in the test section.

Gas concentrations were varied from 0.00 to 0.70 mole fraction carbon tetrachloride. Reynolds number was varied from 520 to 12,700, while the Schmidt number varied from 0.23 to 1.17. Gas temperatures were varied from 68 to 91 degrees Centigrade. All experiments were conducted at atmospheric pressure.

The results may be correlated by either of the following equations:

$$\text{(a)}\quad \frac{k_g RT\, d}{D_v} \cdot \frac{p_{Bm}}{P} \cdot Sc^{-0.44} = 0.0014\ Re^{1.08}$$

$$\text{(b)}\quad \frac{k_g RT\, d}{D_v} \cdot Sc^{-0.44} = 0.00013\ Re^{1.42}$$

The standard deviation of the error in Equation (a) is 15%, while that of Equation (b) is 16%. The equations are applicable throughout the turbulent region studied.

A second method of correlating the data was used for a limited range of Reynolds number. For Reynolds number over 7000 the following partial differential equation applies:

$$\text{(c)}\quad u \frac{\partial c}{\partial x} = \frac{\partial}{\partial y}\left[(D_v + E) \frac{\partial c}{\partial y} \right]$$

Values of eddy diffusivity and velocity used in solving Equation (c) were obtained from the literature. Data published from heat and momentum transfer studies were used. The momentum transfer studies provide the velocity, and heat transfer data were used to provide the eddy diffusivity.

Concentration values from Equation (c) may be used along with gas velocity to calculate evaporation rates. For Reynolds number over 7000, the average deviation between the calculated and experimental evaporation rates is 10.5%.

Conclusions of this work regarding the effect of concentration on mass transfer are as follows:

1. As the experimental data may be correlated with or without a p_{Bm} variable, this term is not established as fundamental.
2. Mass transfer over a wide range is described by Equation (c).
3. The electronic differential analyzer may be used to solve the ordinary differential equations obtained by separating the variables in the partial differential Equation (c).
4. The variation of eddy diffusivity with composition, temperature, and pressure given by

   $$E/_{\nu} = \text{constant}$$

   may be used in correlating results from the air-carbon tetrachloride system.

139 pages. $1.85. Mic 57-188

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

ENGINEERING, ELECTRICAL

THE DESIGN AND DEVELOPMENT OF A SIGNAL RECORDER

(Publication No. 18,899)

Vern Corwin Vanderbilt, Jr., Ph.D.
Purdue University, 1954

Major Professor: J. M. Cage

This thesis deals with the conception, construction, analysis, and testing of a low power signal recorder. The method of controlling the magnetic field of a d'Arsonval type meter is unique and offers a wide range of further applications other than that of a link in the recorder system described herein.

The methods of controlling the magnetic field are described in the introductory section following this abstract, which related various ways for controlling the coil position with the coil current unvarying. If the magnet of a d'Arsonval type meter is removed from the vicinity of the coil, the deflection of the coil in which the current is held constant will decrease. It is evident that this fact allows for the product of the current in the coil and the magnet motion to be indicated by the deflection of the coil.

A closed loop system can be made which will cause the magnet position to be a function of the current in the coil by utilizing the movable magnet meter in conjunction with a sensing device to detect the coil location in relation to a certain fixed deflection. This is the closed loop system of the recorder. A pen is attached to the magnet actuating device and records on a moving chart the signals which are applied to the movable coil.

The unit was constructed by the author using the facilities at his place of business north of the village of Klondike, Indiana. All materials used in the construction were the property of the author.

A development occurred in the analysis of the movable magnet meter which is not common in closed loop systems. Voltages are induced in the coil which result in a momentary torque during the changing field flux caused by the permanent magnet motion. This torque opposes that which the error signal would dictate by the returning closed loop signal. The phenomenon then appears as a real zero of the transfer function for the device on the complex frequency plane.

The unit would be expected to have the same static pivot friction as all d'Arsonval meters; however, because of the dither or vibration caused by the two-phase reversing motor embodied within the recorder, this Coulomb friction is not a cause for large static errors. In fact, the expected error from this cause in the original meter might be two percent of full scale deflection; but in the recorder utilizing this meter, the coil deflection error is much less. The actual pen error is within one percent of the maximum pen travel when the full scale coil current is one sixth of the original meter value.

The design flexibility of a cam to actuate the magnets makes nearly any scale factor possible and also provides for rapid interchange of scales without disturbing the electrical connections within the instrument.

138 pages. $1.85. Mic 57-189

A NONUNIFORM TRANSMISSION LINE AS A FILTER ELEMENT

(Publication No. 19,973)

James Franklin Wilcox, Ph.D.
Syracuse University, 1956

This thesis is concerned with the investigation of a linearly tapered transmission line as a filter element. The particular purpose of the investigation was to obtain and study the filter, or reactance, characteristics of shorted lines of different tapers. This was done both theoretically and experimentally over the frequency band of 450 to 1000 mc.

The theoretical method is based on the use of transmission line equations such as are developed for uniform lines. The applicability of these equations to nonuniform lines depends on the field's being essentially of a TEM (transverse electromagnetic) nature, which was assumed to be the case here. Although some plausible arguments were given to support the assumption, justification of the use of these equations depended on agreement of calculated with measured results.

Since some of the line tapers were appreciable, involving change in characteristic impedance of as much as 3:1 in a quarter wavelength, a number of known methods of solving the differential equations of the line either did not apply or were very hard to use. For this reason a method was developed to give approximate solutions in closed form in terms of well-known functions. The method consists essentially in approximating the coefficients of the given differential equations by those of an equation whose solutions are known. For this purpose, the differential equations are put into convenient normal forms, and the coefficient approximation is accomplished by numerical means. The approximate solutions obtained were confluent hypergeometric, Bessel, or trigonometric functions, depending on the amount and direction of taper. In general, the largest taper required the most general solution function, whereas the smallest taper required the simplest one.

These solutions were used to calculate the desired input reactance characteristics of the shorted line with several different tapers. Reactances are involved rather than impedances because the losses were assumed negligible.

The subject of TEM-wave cut-off was considered briefly. Of the several tapers, only the two extremes (one positive and one negative taper) have cut-off frequencies in the 450-1000 mc band. The positive taper's cut-off is at 531 mc and that of the negative taper is at 860 mc.

Experimental determination of the reactance characteristics was through the use of conventional standing-wave measurements. The overall experimental error was estimated to be about 5%.

Comparison of theoretical with experimental results showed the following:

1) The critical points of the reactance characteristics check within 2.4%.

2) Normalized input reactances of values up to about 15 check very closely for all tapers except the extreme ones. In the worst case the disagreement is about 30%. These curves are very steep so a small shift of one of them shows up as a large disagreement.

3) When the solutions were improved by perturbation, the disagreement disappeared, and the results checked within experimental error.

The following principal conclusions may be drawn from this investigation:

1) The agreement between theoretical and experimental results is very good, so the use of the transmission line equations is justified. The field must certainly be essentially of a TEM nature.

2) The solutions are valid in the cut-off region.

3) The solution method developed is convenient to use when the necessary function tables are available. If it is necessary to compute function values, the use of a digital computer is indicated. The perturbation method is not convenient if numerical integration is required.

4) The method developed for solving the differential equations may be used for a wide variety of linear, ordinary, differential equations of the second order.

164 pages. $2.15. Mic 57-190

ENGINEERING, MECHANICAL

THE INERTIAL ISOLATION OF THE HUMAN HEART AS A FORCE GENERATOR

(Publication No. 17,795)

Paul Arthur Crafton, Ph.D.
University of Maryland, 1956

Supervisor: Professor John E. Younger

As a result of the pumping action of the human heart, a complicated periodic reaction force acts on the heart owing to the acceleratory flow of blood through and from it. One desires to know the characteristics of this heart force, and to lean them without surgically opening the chest. They are indicators of the health of the heart and of the circulatory system.

The heart is suspended in the chest cavity by means of elastic and highly viscous tissue; body flesh is likewise elastic and highly viscous. The human body is a vibrating system excited by the heart force, although the amplitudes of motion are very small indeed. The problem of determining the heart force is one of ascertaining the characteristics of an unknown independent force acting on a mass coupled to another moving mass in a vibrating system, where the magnitude of the mass on which the force acts is unknowable, where the motion of that mass and its coupling to the adjacent mass are unknowable, and where the unknown force is the cause of vibrations in the system. This thesis shows that the characteristics of the unknown force may be ascertained by causing the inertial isolation of the heart, and that this isolation may be effected by applying certain forces to the two platforms on which the individual lies. These platform forces are functions of the body's and platforms' motions, of the dynamic parameters (mass, damping coefficient, and spring constant) of the body, and of the couplings to ground of the two platforms.

When the heart is inertially isolated, the thorax (chest) describes the same motion as does the heart. The measurable thorax acceleration thus bears a constant ratio to the heart force.

Applying platform forces is equivalent to applying a shock force to the heart since the heart's acceleration instantaneously changes when initially isolated inertially. The forces are applied at that instant of time during the heart's pumping cycle when such shock would be a minimum.

Values of the body's dynamic parameters are unique to each individual. These parameters are determined for each patient before his heart is inertially isolated, and determined without injuring the patient.

Since a mutual interdependence exists between the motions of the body and platforms and the isolating force, the possibility of instability and spurious vibrations arises in the vibrating system. Criteria for stability and for the avoidance of spurious vibrations are developed.

The effect of variations in platform forces while the patient's heart is inertially isolated is analyzed, and means by which any dangerous variations may be determined are demonstrated. It is shown that a deliberate variation, as for example an exponential function of time, to eliminate the heart shock force cannot be introduced.

This thesis provides a foundation on which subsequent biological experiments may be based and with reference to which the data of such physiological experimentation may be interpreted. It presents the means by which the characteristics of the heart force function can be learned directly.

266 pages. $3.45. Mic 57-191

WALL EFFECT FOR RIGID AND FLUID SPHERES IN SLOW MOTION

(Publication No. 17,803)

William Lawrence Haberman, Ph.D.
University of Maryland, 1956

Supervisor: Professor Charles A. Shreeve, Jr.

The problem of steady, axial translation of rigid and fluid spheres in a viscous, incompressible fluid bounded by an infinitely long cylinder is considered. Due to the symmetry of the flow, a stream function for the motion exists. The investigation is based on Stokes' approximation for the hydrodynamic equations for slow motion; thus inertia terms can be neglected and the stream function satisfies a fourth order differential equation similar in form to the biharmonic one. The hypothetical case of the steady motion of spheres at the center of a spherical container has also been determined to serve as guide.

The stream function is first developed in spherical coordinates in terms of an infinite series. This expansion is used to satisfy the boundary conditions at the surface of the sphere. An integral solution for the stream function in cylindrical coordinates is obtained, in which the boundary conditions on the cylinder are satisfied. Upon transformation of the cylindrical solution into spherical coordinates, an infinite set of linear algebraic equations is obtained for the determination of the coefficients in the stream function expansion.

An exact solution for the motion of rigid spheres is obtained in terms of such an infinite set. The drag experienced by the spheres is determined numerically over a range of ratios of sphere to cylinder diameter. It is also shown that the first two equations of the infinite set closely

approximate the drag of rigid spheres over a large range of diameter ratios.

For fluid spheres (i.e. spheres which have different physical properties than the external medium and are characterized by internal motion) the problem has been solved to the same approximation. Experimental results for the rigid and fluid case confirm the theory. In general, the results show that the wall effect for fluid spheres is less than for corresponding rigid spheres.

60 pages. $1.50. Mic 57-192

ANALYSIS OF TURBOJET THRUST IN FLIGHT

(Publication No. 18,893)

Walter John Hesse, Ph.D.
Purdue University, 1951

Major Professor: M. J. Zucrow

An F2H-1 airplane was extensively instrumented for the purpose of evaluating several methods of measuring gross and net thrust of a turbojet engine in flight. The theory and test results of 4 methods of gross thrust measurement are presented, and it is shown that several methods produce satisfactory results. The results of the net thrust data are compared to the airplane drag data as obtained from the same airplane by measuring the accelerations in a number of power off dives. It is shown that a satisfactory correlation exists between the flight thrust and flight drag data.

Several methods of measuring air flow rates are also presented, and it is shown that reliable air flow data can be obtained from a very simple instrumentation installation.

The test results of two electrical gross thrust meters are also presented. It is shown that these units, as tested, did not prove reliable at the higher altitudes. The author makes a proposal for a very simple gross thrust meter which will provide accurate results as substantiated by theory and test data.

The instrumentation and calibration requirements for the overall project were extensive; therefore, some discussion is devoted to these subjects.

A short discussion on the radial temperature distribution of the turbine blades of the J34-WE-22 engine is also presented.

It is concluded that, the gross thrust of a turbojet engine in flight is relatively easy to measure, and that the ram drag and net thrust can be properly evaluated with a little more difficulty. It is further stated that, the proposed gross thrust meter which can produce reliable results, can be modified slightly to produce approximate values of the actual net thrust.

268 pages. $3.45. Mic 57-193

VARIABLE RATE TORSION SPRING

(Publication No. 19,711)

Thomas Manos, Ph.D.
University of Michigan, 1956

The intent of this thesis is to introduce a new type of torsion spring into which one of many spring rates can be designed. In addition the analytical investigation leading to the general solutions of this type of spring is presented and supplemented by specific cases of particular interest and their solutions. Fifteen springs of this new type were built and tested on a special testing apparatus. The results of the testing, the description of the equipment and method of experimentation used are also embodied in the thesis.

In general, the spring consists of a pair of relatively rotatable end pieces between which is interposed at least one rod or bar. The position of this rod or bar is such that its longitudinal axis is offset from and parallel to the axis of rotation of the end pieces. The end pieces can be ordinary flat plates, or parts of a machine or mechanism between which a torsional spring action is desired. The manner in which the interposed rod or bar is attached to the end pieces requires that this general type of spring be treated specifically as two kinds.

The spring of the first kind consists of a rod or bar ridigly attached to one end piece and inserted through a snug hole provided in the other. The spring of the second kind consists of a rigid attachment of each end of the bar or rod to an end piece.

The theoretical investigation is composed of two approaches. The first approach employs the principles and assumptions standard with elementary beam theory. This course rendered results which are not only reliable but also the simplest in form. The solution obtained for the spring of the first kind is

$$T = \frac{3NEr}{L^3}\sqrt{I_y^2\sin^2\theta + I_x^2(1-\cos\theta)^2}$$

$$\left\{\sin\left[\theta + \tan^{-1}\left(\frac{I_y}{I_x}\cot\frac{\theta}{2}\right)\right]\right\}$$

where T is the torque required to rotate the end piece, N the number of interposed bars, r the distance from the longitudinal axis of the bar to the spring axis, L the length between end pieces, I_x the moment of inertia about the x axis of the bar, I_y the moment of inertia about the y axis of the bar, θ is the relative rotation of the end pieces, and E is the Modulus of Elasticity.

The spring rate, or relationship between T and θ, is adjusted by properly selecting a ratio of I_y/I_x.

The application of this elementary approach to the spring of the second kind requires the use of two approximations, the first is used to determine the distance between the end pieces, and the other to solve the differential equation of motion. The solution obtained, which is to lengthy to present here, is in a series form. The second theoretical approach employed the principles and assumptions used in the large deflection beam theory. This approach gave only slight improvement over the above and rendered the general solution in terms of eliptic functions. The application of this general solution to a specific spring requires that a procedural form be followed.

The results of the analytical investigation were subjected to the test of comparison with the experimental

measurements. The agreement between the observed average and the theoretical prediction, using the elementary approach, was found to be within 1 per cent for the spring of the first kind, and within 3.3 per cent for the spring of the second kind. The agreement between the advanced theory and experimental average was found to be within .5 per cent for both kinds of springs.

The experimental and analytical phases of the work offered many suggestions which can be used in the design of this type of spring. These suggestions are offered in the form of design section. 124 pages. $1.65. Mic 57-194

HEAT TRANSFER FROM PLANE SURFACES TO AIR AT HIGH VELOCITIES (SECTIONS I-III)

(Publication No. 18,891)

Arcot Ramachandran, Ph.D.
Purdue University, 1949

Major Professor: Dr. G. A. Hawkins

This thesis deals with the study of the heat transfer from a plane surface to air at high subsonic velocities. For the purpose of presentation, this work is divided into three sections.

Section I covers in detail the design, construction and operating characteristics of the high speed wind tunnel over the desired Mach number range.

Section II presents a survey of the literature on aerodynamic heating of various shaped bodies in air streams at subsonic and supersonic velocities, and the present experimental investigation. Two dimensionless correlations were arrived at, for the recovery factor, r over a Mach number range of 0.3 to 0.85 and a Reynolds number range of 5 (10^5) to 2.5 (10^6). They are

$$(1 - r) = 0.1235\ (N_{Ma})^{-1.1647} \qquad [a]$$

and

$$(1 - r) = 0.805\ [N_{Ma}(N_{Re})^{.1144}]^{-1.14} \qquad [b]$$

The above equations represent the experimental data with a probable error of correlation for r of 2.83 per cent and 3.015 per cent respectively. The above correlations may be used in the turbulent boundary layer at supersonic velocities, as the limited amount of data available in the literature agrees well with the correlations.

Section III deals with the experimental investigation of the heat transfer from an electrically heated plane surface to air streams in parallel flow at high subsonic velocities, in the turbulent boundary layer. The experimental data have been correlated and are represented by the following equations

$$N_{Nu} = 0.008\ (N_{Re})^{0.9013} \qquad [c]$$

and

$$(N_{Nu})_{L_{tot}} = 0.0123\ (N_{Re})^{0.876}_{L_{tot}} \qquad [d]$$

The above equations represent the experimental data with a probable error of correlation of 3.83 and 4.26 per cent respectively. The present results may also be represented by the following equations

$$N_{Nu} = 0.0332\ (N_{Re})^{0.80} \qquad [e]$$

and

$$(N_{Nu})_{L_{tot}} = 0.038\ (N_{Re})^{0.80}_{L_{tot}} \qquad [f]$$

These two equations represent the experimental data with a probable error of correlation of 5.78 and 4.27 per cent respectively.

The test results are compared in dimensionless form with various proposed correlations in the turbulent boundary layer. Equation e is 3.4 per cent higher than Colburn's correlation of the data of Juerges and Elias. Based on the results of this investigation, the following conclusions can be reached.

1. The incompressible flow flat plate heat transfer correlations for the turbulent boundary layer can be used at high subsonic velocities provided the coefficient of heat transfer is based on the modified temperature potential; namely, $(t_w - t_{aw})$.
2. The kinematic viscosity be evaluated at the static temperature of the air stream and the thermal conductivity at the film temperature t_f, defined by $(t_w + t_{aw})/2$.
3. The results of this investigation can be extrapolated to supersonic velocities. 179 pages. $2.35. Mic 57-195

ENGINEERING MECHANICS

CYLINDRICAL SHELLS UNDER LINE LOAD

(Publication No. 19,686)

Robert Marion Cooper, Ph.D.
University of Michigan, 1956

This dissertation is concerned with thin elastic cylindrical shells under the action of edge loads in general, and line loads (along a generator) in particular. While the problem of the cylindrical shell under the action of a line load has received considerable attention in the literature, in all previous treatments of the problem (by various approximations of the classical theory of shells) the effects of both transverse shear deformation and normal stress have been neglected. It may be mentioned that the neglect of these effects, especially the former, may result in serious error as evidenced by a few available solutions of other problems of shells and plates.

The basic equations of the approximate theory and the resulting differential equations (designated as system I) employed in this study are those appropriate for shallow cylindrical shells. This system of equations constitutes a special case of the equations of the general shallow shells, given recently by Naghdi, where the effect of transverse shear deformation is included. The character of the system of equations (I) is such that, upon the neglect of transverse shear deformation, it reduces to the corresponding equations of cylindrical shells (labelled as system II), due to Donnell. In support of the validity and accuracy of equations I, it may be mentioned that in a recent study (by Naghdi and Cooper) dealing with the axisymmetric propagation of elastic waves in a cylindrical shell, the comparison between the predictions of I with the more complete

and exact system of equations of shell theory was found to be excellent.

Following the presentation of the general solution of equations I (expressed as Fourier series), the problem of a cylindrical shell of finite length with simply supported ends is considered in detail. Comparison is made between the predictions of the two systems of equations (I and II) for the case of a uniform line load applied over a segment of shell generator, for various values of: radius (a) of cylindrical shell to its length (L), the loaded length (ℓ) to (L), and the thickness (h) to radius (a). It is found that in the range $1/5 < h/a < 1/30$, the predictions of the system of equations II as compared to those of the system I equation for the radial displacement (deflection) may be in error by as much as 25 percent. The corresponding errors for the predicted stresses are negligible.

81 pages. $1.50. Mic 57-196

ENGINEERING, METALLURGY

THE INFLUENCE OF SURFACE AND SUBSURFACE VARIABLES ON THE FATIGUE PROPERTIES OF TITANIUM AND ITS ALLOYS

(Publication No. 19,690)

Albert William Demmler, Jr., Ph.D.
University of Michigan, 1955

The recent development of titanium and titanium alloys as engineering materials has made essential the study of their fatigue properties. New developments in the study of fatigue have indicated the statistical nature of this phenomenon. Because of these factors the object of the present study has been to determine the rotating beam fatigue properties of five titanium alloys, to investigate the effects which surface and subsurface variables have upon these properties, and to apply statistical analyses to the interpretation of the data.

Both notched and unnotched fatigue data were obtained using the above mentioned five alloys. The major study was confined to Ti-75A, commercially pure titanium, and RC-130B, a two-phase alloy. Additional studies were carried out on RC-A-110AT, an alpha solid solution alloy, and special all-alpha and all-beta alloys. The fatigue data were taken in such a manner that they could be treated in a statistical fashion. X-ray investigations were made of the preferred orientations present in the material, the depth at which spot-sharpening in forward-reflection photographs took place, and the relationships between the depth below the surface and the angular displacement of the lines resulting from a given set of crystallographic planes. Metallographic examinations of the surface and subsurface were made of all of the materials tested in order to relate the fatigue properties to these structures. Surface roughness determinations were made upon the surfaces, microhardness traverses across the specimen sections were made, and the internal friction properties of the two primary materials were briefly studied. The effect of rate of testing on the fatigue characteristics was also investigated.

It was found that there were considerable differences between the fatigue properties of the variously prepared surfaces. The determinations of the standard deviations of the various groups of specimens showed that the scatter in results for the titanium alloys was approximately the same in magnitude as for other metallic materials. X-ray and metallographic examinations showed the variations in the depth of subsurface alterations caused by the steps taken in specimen preparation and permitted the determination of the sense of the surface stresses and their approximate relative magnitudes. Internal friction studies were not particularly conclusive. Microhardness traverses could be correlated with the depths of alteration as determined by x-rays but were subject to a great deal of statistical variation. Commercially pure titanium was found to heat internally during fatigue testing.

The effect of shot peening on Ti-75A was to improve the fatigue properties while that of grinding was to impair them. The remaining mechanical type finishing operations on unnotched specimens caused little variation. Shot peening generally increased the short life fatigue properties of all the alloys studied but only increased the endurance limit for Ti-75A. Grinding lowered the endurance limit in every case. Surfaces produced by introducing interstitial alloying elements decreased the fatigue properties. Machined notches were not as severe, while ground notches were more severe, than would be predicted by their K_T values. Rolling the notch into the surface results in effectively complete removal of the notch sensitivity, q, in all the alloys investigated. While masked by other variables, the effect of surface roughness on the fatigue properties seems to be quite small. The relationship between the endurance limit and the tensile strength was found to be good. Heat-to-heat variations were shown to be of only minor significance. Depth of penetration of surface alterations were not found to have any marked degree of correlation with the fatigue properties except insofar as the depth is related to the severity of preparation. The speed of testing, within the range investigated, is not an important factor and the cause of internal heating in the testing of Ti-75A can be ascribed to internal friction and the presence of hydrogen in the metal.

298 pages. $3.85. Mic 57-197

MECHANICAL PROPERTIES OF INTERNALLY OXIDIZED BINARY SILVER ALLOYS

(Publication No. 19,507)

Paul D. Gorsuch, Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professor: Dr. Robert L. Fullman

The strength and hardness of dilute binary alloys of silver containing aluminum, magnesium, or zinc are found to increase as a result of internal oxidation. The increases are functions of both the solute type and concentration and the atmosphere and temperature used in the oxidation process. The strength and hardness increases cannot be correlated with the free energy of formation of the oxides except at low oxidation rates.

Oxidation at low temperatures and in atmospheres of high oxygen content produces the greatest increases in strength and hardness in all alloys. In general, however,

the effect of oxidizing conditions is small on the properties of the Ag-Al and Ag-Mg alloys and very pronounced for the Ag-Zn alloys. Both trends are considered to reflect the complex factors involved in the nucleation and growth of precipitated phases.

The rate of formation of the subscale is much greater at the surface than at a finite depth in the test samples, as the depth of penetration of the subscale is proportional to the square root of the oxidation time. It is suggested that the high rates of movement of the oxidation boundary near the surface of the sample is conducive to the formation of metastable precipitates. For the Ag-Zn alloys, the metastable precipitates are simply finer dispersions of incoherent oxide particles which have a marked tendency to coalesce with continued holding at temperature. For the Ag-Al and Ag-Mg alloys, the metastable precipitation is accompanied by marked shifts in lattice parameters and unusually high electrical resistivities. These properties return to more normal values after holding for extended period of time at elevated temperatures. The types of precipitates which would produce these unusual changes are discussed, but available data cannot be used to discern which is the most probable. The depth to which the higher-hardness zone containing metastable precipitates extends in an oxidized sample is considered to be a function of both solute concentration and oxidizing conditions.

Oxidation in the cold-drawn condition results in greater strength, hardness and ductility, as measured by elongation to fracture, than does oxidation in the annealed condition. Part of the differences can be attributed to much finer average grain sizes, but part also results from a greater tendency for metastable precipitation to occur, particularly in the Ag-Mg alloys. An explanation for this behavior, based on dislocation theory, is discussed.

Samples oxidized with coarse grain structures (annealed at 900°C) are subject to marked intergranular brittleness at hardnesses greater than 150-160 VHN. Intergranular brittleness is not severe in fine-grained samples except at hardnesses greater than 200 VHN. These hardness values correspond to yield strengths of 55,000 to 60,000 psi and 80,000 to 90,000 psi, respectively.

The linear correlation between yield strength and hardness and the square root of the volume fraction of oxide for each series of alloys appeared to be an experimental verification of the Orowan criterion for yielding. However, the fact that the relation holds over a wide range of oxide particle sizes and the fact that the variations in properties with test temperature do not show the proper temperature dependence suggests that a much more complex theory is required to completely describe the deformation behavior of these alloys.

The annealing characteristics of oxidized and cold-drawn Ag-Zn alloys are normal, with the exception that the oxide particles restrict the tendency for grain growth after recrystallization. The softening of the Ag-Al and Ag-Mg alloys, however, is not accompanied by visible evidence of recrystallization or grain growth, even at temperatures up to 900°C. The influence of coherent precipitation of oxide particles is discussed as a possible explanation for this unique behavior.

The increase in flow stress of the Ag-Zn alloys due to dispersion work hardening is proportional to the volume fraction of oxide to the 1/2 power rather than the 3/2 power as predicted by the theory of Fisher, Hart and Pry. The behavior of the Ag-Al and Ag-Mg alloys cannot be described in generalities, however, as the results are greatly dependent upon the condition of the alloy.

205 pages. $2.70. Mic 57-198

THE PRODUCTION, TESTING AND JOINING OF POROUS STAINLESS STEEL SHEET BY POWDER ROLLING

(Publication No. 19,512)

Donald A. Perry, Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professor: Dr. Fritz V. Lenel

A method of fabricating porous stainless steel sheet with a controlled permeability by a powder rolling technique has been developed using a conventional 2-high rolling mill. The powder rolling variables, roll gap, and powder feed rate are discussed and related to sheet thickness, porosity, and permeability. Sheet thickness from 0.016 inches to 0.050 inches have been produced with porosities ranging from 16% to 27%. Controlled permeability coefficients up to 10×10^{-10} in.^{2} have been obtained. This is within the recommended range for transpiration cooling. Tensile strengths of 29,000 psi for -100 + 200 mesh, 302B powder with 22% porosity have been found. Bend-ductility data indicate that the porous sheet can be bent around radii in the range between 2 and 5 times the sheet thickness depending upon its thickness. Preliminary results on seam welding of the porous sheet to solid grooved struts simulating transpiration-cooled turbine blades are discussed.

119 pages. $1.50. Mic 57-199

SOME EFFECTS OF HYDROGEN ON THE MECHANICAL PROPERTIES OF IRON AND STEEL

(Publication No. 19,513)

Harry C. Rogers, Jr., Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professor: Dr. Arthur A. Burr

The problem of this investigation is to determine whether or not hydrogen can suppress the yield point in steel and, if so, to elaborate the phenomenology of this suppression. The limited literature relating to such an effect is reviewed, and the theory necessary for the design of critical experiments and the evaluation of their results is briefly discussed.

Specimens of Armco iron, SAE 1020 steel, and rimmed steel are charged electrolytically with hydrogen and the influence of charging, material, and testing variables studied by means of a tensile test. The hydrogen contents of the specimens were not, in general, analyzed.

It is shown that the yield point can be eliminated in Armco iron at room temperature. Further studies show that this charged iron begins to yield discontinuously as the test temperature is lowered to -12C. Decreasing the test temperature further leads to an increasing yield point.

A yield point which is due to hydrogen is shown to exist and its temperature dependence studied in Armco iron and SAE 1020 steel. Since this yield point only appears at test temperatures of -80C. or below, it is concluded that

the one which appears at -12C. after hydrogen charging is not due to the hydrogen per se.

Experiments were carried out on specimens of charged rimmed steel to determine the kinetics of the return of the yield point on aging after its elimination by charging. The measured activation energy for its return is 26,000 calories per gram mole. Identical charged specimens were also aged to determine the kinetics of the return of ductility after hydrogen embrittlement. The measured activation energy was 17,700 calories per gram mole, comparable with that for permeation of hydrogen through ingot iron.

The influence of hydrogen charging on the carbon and nitrogen internal friction peaks in iron is measured, using a torsional pendulum. No significant influence was found.

The influence of material and electrolytic charging variables on the yield point elimination is studied.

Rimmed steel sheet which has been temper rolled to eliminate the yield point at room temperature is shown to exhibit a yield point when tested at -78C. This clarifies the role of residual stresses in the suppression of the yield point.

A mechanism by which hydrogen atoms interact with dislocations cannot explain most of the results of the critical experiments, and is, therefore, discarded. The yield point suppression by the mechanism of the production of macroscopic inhomogeneities in steel by hydrogen charging is shown to be capable of explaining most of the experimental results. However, neither of the two detailed mechanisms of this type which are discussed is able to explain all of them satisfactorily. These mechanisms propose that the hydrogen eliminates the yield point by:

a. Concentration gradients of lattice hydrogen which give rise to inhomogeneous elastic stressed,

or

b. Local regions of plastic deformation which spread when the specimen is deformed.

Further experimentation is necessary to evaluate them critically.

An appendix is included which is a tabulation of the experiments performed to evaluate the influence of material and charging variables on the yield point elimination.

150 pages. $2.00. Mic 57-200

A QUALITY CONTROL PROGRAM FOR THE PROCESSING OF SWEET CORN

(Publication No. 17,809)

Aaron Kornetsky, Ph.D.
University of Maryland, 1956

Supervisor: Professor Amihud Kramer

The variability that exists in food materials has been a deterrent in the application of statistical quality control charts to food manufacturing processes. While it is recognized that food products are more variable than the manufactured articles of other industries this in itself does not exclude the use of control charts; it merely indicates that control limits must be wide and must be adjusted to the situation.

Research at the University of Maryland and other institutions had provided a number of tools with which quality factors in sweet corn might be readily evaluated objectively, thus the necessity of developing a comprehensive program for the application of this knowledge to actual production problems seemed evident. Quality control charts were, therefore, instituted in two sweet corn processing plants to accomplish this objective. Both cream style and whole kernel packs were represented in the study.

Control stations were established at the receiving, in-plant, and finished product points of production. Such factors as maturity, defects, insect infestation, cut-off, and consistency were charted. The relationships between raw product, in-plant, and finished product controls are discussed with the aid of statistical control charts. Adjustment of limits are suggested to make the charts more useful and informative in special situations. Suggested data sheets are presented for use at the various quality control stations.

The development and evaluation of objective methods to measure quality factors were continued as a corollary to the quality control study. High points of these related studies are the investigations of methods for evaluating the pericarp content of sweet corn and the development of prediction curves which indicate the following:

1. The expected consistency of processed cream style corn after storage as predicted from the consistency at the time of filling.
2. The expected yield (cases of number 303 cans/ton of raw corn) of whole kernel sweet corn as predicted from the trimetric maturity score.
3. The expected percent pericarp content of processed whole kernel sweet corn as predicted from the pericarp content of the raw corn.
4. The expected percent increase in drained weight of whole kernel sweet corn as predicted from the trimetric maturity score at the time of filling.

147 pages. $1.95. Mic 57-201

PROTEOLYTIC ENZYMES OF BACILLUS STEAROTHERMOPHILUS

(Publication No. 17,515)

Robert Thomas O'Brien, Ph.D.
State College Of Washington, 1956

A protease produced at 55°C. by Bacillus stearothermophilus, 1503 was purified and studied. The purification resulted in a 20 to 40 fold increase in specific activity over the original culture filtrate. The purified enzyme was stable at 55°C. but not at 65°C. Maximum activity was obtained at 55°C. at pH 6.9 to 7.2. The enzyme required no organic co-factors but Ca^{++} or Mn^{++} were required for activity. Of 10 synthetic peptides tested only leucylglyclyglycine and glycylglycylglycine were hydrolyzed indicating the enzyme was a tripeptidase. Casein, gelatin, alkaline hemoglobin, and alpha soy protein were also hydrolyzed by the enzyme. Hydrolysis of casein followed first-order kinetics, zero-order kinetics were followed in the hydrolysis of leucylglycylglycine. The different kinetics on the two substrates were due to a difference in concentration. Electrophoretic analysis of the purified enzyme solution showed the presence of a major and a minor component. Activity was inhibited by the sulfhydryl inhibitors N-ethylmaleimide and p-chloromercuribenzoate. The inhibition by these compounds was reversed with glutathione.

The addition of carbohydrate or aeration during enzyme production resulted in no proteolytic activity in the cell free filtrates.

It was concluded that thermophiles are able to grow at high temperatures because they can synthesize enzymes which are stable and active at the temperature of growth.

45 pages. $1.50. Mic 57-202

PROGRESS IN THE DEVELOPMENT OF AN ELECTRO-CHEMICAL METHOD FOR THE MEASUREMENT OF VOLATILE FLAVORS IN VEGETABLES

(Publication No. 19,791)

Wayne Earnest Tolle, Ph.D.
Cornell University, 1956

Chairman: John D. Hartman

The purpose of this research was to develop a rapid objective method for evaluation of volatile flavors in horticultural products. The advantages and need for such objectiveness are understood by all persons concerned with repeated and extensive flavor estimations by subjective taste panels. The attributes of flavor due to volatile constituents have been without satisfactory measure that was objective and rapid.

The objective method described is essentially an extension of the work of Hartman. The method used in this work consisted of a standardized presentation of a mixture of air and the vapors of volatile flavoring constituents to the liquid junction of a sensitive element. This sensitive element, for the results reported, consisted of a small glass-tipped, platinum wire electrode dipping in a buffered electrolyte, the whole constituting a half cell. The other and complementing half cell was a large platinum plate in the same buffer. In general, potentials under one volt were impressed on the cell and the sensitive element thus polarized. Reactions of flavor volatiles at the liquid juncture of the sensitive element were automatically charted by a micro-micro-ammeter recorder as changes in electrical current passing through the cell. Tested compounds included representatives of aldehydes, amines, sulfur compounds, alcohols, organic acids, terpenes, heterocyclic compounds, and esters. It was reasoned that if the method could qualitatively and quantitatively show a difference between these test compounds, this would be sufficient index of its probable practicability in objective flavor evaluations. A few exploratory tests were made also upon asparagus, chives, instant and ground coffees, muskmelons, rhubarb, cloves, cinnamon, nutmeg, air, and upon various distilled waters.

Results of 597 tests are summarized in tabular form. The data are based upon the use of a single uncoated electrode, at three test voltages and at four pH values of electrolyte. However, various electrodes, coated or uncoated with enzymes or other substances, may be easily substituted. It is in the almost unlimited possibilities of such substitutions that the promise of the method seems to lie. Photographs of response curves demonstrate the reproducibility of results. Contamination problems of test substances and of the apparatus were extremely troublesome, because, for many volatiles, the apparatus appears to be more sensitive than is the human nose. Results are charted by the apparatus in approximately 64 seconds.

It appears conclusive that rapid and reproducible responses to many flavor volatiles can be obtained with the system discussed. Whether the various sensitive elements, by this system, can discriminate among all flavor differences, remains to be more fully tested. It appears that, at the very least, the apparatus may soon be applied to special cases where flavor is due to single or simple combinations of volatiles. 93 pages. $1.50. Mic 57-203

GEOGRAPHY

SETTLEMENT IN THE FOREST LANDS OF MANITOBA, SASKATCHEWAN, AND ALBERTA: A GEOGRAPHIC ANALYSIS

(Publication No. 19,724)

Burke Gordon Vanderhill, Ph.D.
University of Michigan, 1956

The purpose of this study is to analyze the nature, direction, and purpose of settlement in the forest lands of the three Prairie Provinces of Canada in the light of the natural, economic, social, and political conditions which have played a part in such settlement.

In the first three chapters, settlement and development from 1670 to the close of the Second World War are examined. The fur trade accounted for most of the exploration and development in the northern forest until 1870, although a limited settlement took place near fur posts and missions late in the "fur era." During the years 1870-1930, development took place within the framework of the land and resource policies of the new Dominion of Canada which were dedicated to the task of populating the West as rapidly as possible. After 1930, northern lands were developed under provincial policies which incorporated increasing elements of control over the patterns of settlement, the outgrowth of problems of maladjustment which plagued the forest frontier.

In Chapters IV and V, the contemporary scene is examined, being construed as the period following the close of World War II. The contemporary frontier is an area of resource appraisal and planned development. In the case of agricultural settlement, the approach of the three provinces is at some variance. Manitoba concentrates much settlement in provincial projects. Saskatchewan restricts entry on unsurveyed lands and fosters co-operative farming in some new lands. Alberta opens lands to settlement only after preliminary land and economic surveys. Beyond the agricultural frontier, development in all three provinces is under restrictive control in the attempt to prevent speculation and exploitation. Saskatchewan is unique in her policy of establishing government enterprises in the north and promoting co-operative organization.

Conclusions drawn from the study can be grouped in three broad categories. 1) People have been attracted to the northern forest for a number of reasons and these reasons have varied through the history of settlement. The first lure was fur. After 1870, the attraction of free or relatively cheap land was paramount, although western Canada also served as a refuge for certain religious or ethnic groups. In the late twenties and early thirties of the Twentieth Century, the forest served as a refuge for Canadians fleeing drought and depression conditions elsewhere. Presently, the forest serves as an outlet for the natural population increase in the Prairie Provinces. 2) The limitations of the northern forest and the problems facing new settlers are numerous. Among the more important problems have been generally poor soils, short and highly variable growing seasons, unreliability of rainfall, inadequacy and high cost of transportation, difficulty in securing adequate educational and other social services, comparatively low levels of living, and harshness of frontier life. The most critical factor in the success of agricultural settlement seems to be the nature of the soils, and the pattern of population reflects to a considerable degree this factor. 3) Most of the future settlement in the northern forest will be based, as in the past, upon

agriculture, and it will necessarily take place in Alberta. Only scattered areas of arable lands remain unoccupied in Manitoba and Saskatchewan and such areas generally require drainage and reclamation work. Beyond the farm frontier, only a limited and scattered settlement can be expected, associated with mining, commercial fishing, forest industries, and tourism. While the northern forest lacks the potential to support large numbers of people, its function as a safety valve for the natural increase of the Prairie Provinces and as the source of minerals of economic and strategic value to the Dominion lends it significance. 315 pages. $4.05. Mic 57-204

GEOLOGY

GEOLOGY AND GEOCHEMISTRY OF THE WOLFRAMITE DEPOSITS IN SOUTHERN STEVENS COUNTY, WASHINGTON

(Publication No. 17,508)

Frank Hawver Howd, Ph.D.
State College Of Washington, 1956

The Deer Lake area, located in southeastern Stevens County, Washington, is underlain by a series of slightly metamorphosed sedimentary strata which form the east limb of a northwestward plunging syncline. Two northerly striking normal faults are present at the west edge of the mapped area. With the exception of Mississippian – Pennsylvanian limestones and dolomites occupying the area between the normal faults, the metasediments are believed to be Precambrian Beltian in age. Late Cretaceous quartz monzonites of the Loon Lake batholith and Tertiary andesite porphyry have intruded the metasediments. Remnants of Miocene basalt flows are common in the west portion of the area.

Wolframite mineralization of economic importance occurs at two localities in southern Stevens County. These localities are Blue Grouse Mountain in the southeast corner of the mapped area, and the Germania – Germania Consolidated area in the southwest part of the county. Wolframite in the Germania area occurs in a series of northeasterly striking quartz veins dipping steeply to the southeast, and enclosed in a quartz monzonitic cupola of the Loon Lake batholith. The hydrothermal fluids were responsible for the mineralization and four zones of wall rock alteration. Successive zones from fresh rock toward a quartz vein are characterized by argillization, argillization and chloritization, sericitization, and sericitization and silicification. It is postulated that the solutions causing this alteration were hot dilute acids.

At Blue Grouse Mountain, where the ore mineral is hübnerite, the ore bodies are of two types: (1) northwesterly trending quartz veins dipping west at moderate angles in arkosic siltstone, and (2) disseminated deposits in altered quartz monzonite. The siltstone has been sericitized and pyritized by acid hydrothermal solutions. The quartz monzonite was strongly altered to quartz and muscovite prior to mineralization. The hydrothermal mineralizing fluids caused no further alteration other than minor silicification.

The manganese:iron ratios in wolframite from the Germania – Germania Consolidated area are shown to vary between 0.52 and 2.89 as determined by chemical means, and between 0.47 and 1.52 as determined by X-ray fluorescent spectrometer. The manganese:iron ratios in hübnerite from Blue Grouse Mountain vary between 17.5 and 62.3 as determined by chemical analyses and between 21.9 and 40.4 as determined by X-ray methods. There is no correlation between the manganese:iron ratios of minerals of the wolframite series and the positions of these minerals in the geologic setting.

91 pages. $1.50. Mic 57-205

A STRATIGRAPHIC STUDY OF THE PERMIAN FORMATIONS OF PART OF SOUTHWESTERN MONTANA

(Publication No. 17,976)

Lawrence Frederick Rooney, Ph.D.
Indiana University, 1956

Chairman: Dr. W. R. Lowell

The thesis area is located roughly in the polygon circumscribed by Divide, Three Forks, Avon and Philipsburg, Montana, and contains the northern limits of the western phosphate field. The Permian sedimentary sequence in the thesis area comprises three formations with five members. They are, from bottom to top: the Park City formation, Franson member; the Phosphoria formation, Retort phosphatic shale and Tosi chert members; and the Shedhorn sandstone, lower and upper members.

The Park City formation is composed dominantly of dolomite, which grades into clastic rocks in the northeastern part of the area. The Retort member of the Phosphoria formation is composed dominantly of carbonaceous phosphate rock, mudstone and siltstone, and interfingers with the Tosi chert to the northeast. The Tosi member is composed dominantly of thin-bedded chert, with minor phosphate rock, dolomite, siltstone and sandstone. The Shedhorn sandstone is composed of fine-grained quartzite or sandstone. All the formations thin to the north and east.

The Retort and Tosi members are considered trough and platform facies respectively. The phosphate rock of the platform facies is more oolitic, siliceous, sandy and fossiliferous and less carbonaceous, argillaceous, phosphatic and calcareous then that of the trough. The origin of the chert, dolomite and phosphate rock is uncertain, but a cyclical repetition of chert, dolomite and phosphate

rock in the platform facies suggests a rhythmic variation of environmental conditions.

The only identified phosphate mineral is the carbonate-hydroxyl-fluorapatite member of the apatite group called francolite. It occurs generally in a cryptocrystalline form called collophane and a microcrystalline form called "francolite." Although "francolite", as used in some of the literature appertaining to the western phosphate field, is a petrographic designation, the confusion is not serious because francolite is the only member of the apatite group identified from the area. Chemical analysis indicating fluorine, hydroxyl and carbonate are necessary to corroborate the X-ray identification of francolite.

In the trough facies, montmorillonite, illite and kaolinite are abundant; chlorite and mixed-layer montmorillonite-illite are minor. The abundance of montmorillonite and kaolinite are unusual and may be attributed to hydrothermal alteration, original deposition or volcanic activity. Theoretical considerations favor original deposition, but circumstantial evidence favors hydrothermal alteration. In the platform facies, illite is the most abundant clay mineral; chlorite, kaolinite and mixed-layer montmorillonite-illite are minor.

C^{12}/C^{13} ratios of samples collected from within the thesis area and south of Dillon show enrichment of the lighter isotope in the organic carbon of the Retort member. Comparison with C^{12}/C^{13} distribution in plants grouped according to ecology suggests that the Retort Sea was stagnant. The contoured ratios suggest that a normal marine environment lay to the northwest.

150 pages. $2.00. Mic 57-206

HEALTH SCIENCES

HEALTH SCIENCES, PATHOLOGY

ARTERIOSCLEROSIS: EXPERIMENTAL AND CLINICAL INVESTIGATIONS OF ITS ETIOLOGY AND PATHOGENESIS WITH SPECIAL REFERENCE TO ACUTE MYOCARDIAL INFARCTION

(Publication No 17,191)

Kyu Taik Lee, Ph.D.
Washington University, 1956

Chairman: Dr. W. Stanley Hartroft

Arteriosclerosis is the leading cause of death in many regions of the world. The pathogenesis of arteriosclerosis is an exceedingly complex process involving the interplay of numerous factors. It has been the object of intensive research for many years. The general object of the studies herein reported is to add to our basic knowledge concerning arteriosclerosis with special reference to acute myocardial infarction.

Part I is a review of the literature concerning significant contributions in the field of arteriosclerosis.

Part II deals exclusively with factors associated with coronary arteriosclerosis in autopsied patients who died with an acute myocardial infarct. During the period 1910 to 1954, 8183 autopsies were performed on adults from Barnes Hospital and among these were 500 with acute myocardial infarction. A review of the vast experience that these autopsies represent has provided objective confirmation of many widely held theories, and in addition has disclosed new data that may be of profound significance.

One important observation reported from this large autopsy series is that a shift has occurred in the relative incidence of acute myocardial infarction in the two sexes. In the period 1910-1939 the incidence was twice as high among men as it was among women (ratio 2:1). In the period 1940-1954 the incidence was not significantly different in the two sexes (ratio 1.1:1). This changing ratio between the sexes was due largely to a disproportionate increase in the incidence of the disease among elderly women. On further analysis, since 1940, acute myocardial infarction is significantly more common among diabetic women than among diabetic men whereas the incidence is still significantly greater among non-diabetic men than among non-diabetic women.

Acute myocardial infarction is twenty times more common among the Barnes Hospital autopsy population in the decade 1945 through 1954 (incidence of 10%) as compared with the decade 1910 through 1919 (incidence of 0.5%). This increase in incidence was found in all age groups and both sexes.

Diabetes mellitus is four times as common among patients with acute myocardial infarction as it is in the general autopsy population (adults), indicating that it is an important etiological factor.

According to the method we used in the current study hypertension and body weight do not appear to be significant factors in the production of coronary arteriosclerosis and acute myocardial infarction.

Almost half of the 500 patients had anatomical evidence of old infarction in addition to their recent myocardial infarcts. Only 25% of the patients with old myocardial infarcts gave a history of previous myocardial infarction. The average length of time between the earliest previous myocardial infarction and death was 3.3 years.

Twelve per cent of the total patients with acute myocardial infarction had a surgical operation within one month of death. Only half of these patients were diagnosed during life as having acute myocardial infarction. In 62% of these 60 post operative patients, a fall in systolic blood pressure of 50 or more mm Hg was recorded during the operation.

Adequate early anticoagulant therapy is effective in reducing the thromboembolic complications of acute myocardial infarction. However, myocardial rupture was more frequent among patients with acute myocardial infarction who were treated with anti-coagulant drug than among those without anticoagulant therapy.

Part III deals exclusively with the experimental

production of arteriosclerosis. Pulmonary arteriosclerosis was produced in rabbits by repeated intravenous injections of thromboemboli but was not produced by repeated intravenous injections of plastic spheres. These experiments suggest that the pulmonary arteriosclerosis associated with thromboemboli result directly from the organization of thromboemboli and not from pulmonary hypertension. 301 pages. $3.90. Mic 57-207

DETECTION OF PATHOGENIC STRAINS OF VIRUS IN NEWCASTLE DISEASE VACCINES

(Publication No. 19,133)

Arnold Samuel Rosenwald, Ph.D.
The University of Wisconsin, 1956

Supervisor: Professor Carl A. Brandly

The standardization necessary for the development of safe and potent veterinary biologicals did not come with the passage of the Virus Serum Act in 1913. Even today after several modifications of the Act and the intervening years of research some vaccines are sold that are not safe or potent.

Living Newcastle disease vaccine was first licensed in 1948 and now is the leading vaccine for veterinary use on the basis of the number of doses distributed. Two types of strains differing in pathogenicity, i.e., mesogenic (moderately pathogenic) and lentogenic (mildly pathogenic) are used for producing living virus ND vaccines. Methods of quickly and accurately identifying the types of strain are necessary to ensure safety and purity. Means of differentiation are: death time of chicken embryos and lethality for day old chickens inoculated intracerebrally.

A method was needed to differentiate the mesogenic type viruses from the more pathogenic, velogenic strains. Intravenous or intramuscular inoculation of 6-week old chickens could be utilized to distinguish velogenic strains from the mesogenic strains used as wing-web vaccines.

Contamination of mesogenic strains with velogenic strains of high pathogenicity could be detected. However intravenous or intramuscular inoculation of mixtures did not uniformly provide evidence of the presence of highly pathogenic strains; interference by the vaccinal virus prevented full expression of the pathogenicity of the velogenic contaminant.

Vaccination of 4 to 6 week chickens by intramuscular inoculation of mesogenic strain vaccine with high virus content was found to give a satisfactory response and immunity to Newcastle disease even if the vaccine was contaminated by a velogenic strain.

Factors that could modify the detection test are reported. Devitalizing factors such as concurrent coccidiosis infection were demonstrated to influence adversely the response of susceptible 6-week old chickens to intramuscular inoculation with a mesogenic strain; this effect was more severe than that caused by administration of a mesogenic vaccine contaminated with a velogenic strain of Newcastle disease virus.

The two mesogenic strains Roakin and MK 107 were further characterized and compared as to pathogenicity and rate of spread. Contact spread of Newcastle disease virus to unvaccinated penmates, followed intramuscular vaccination with strain MK 107, inducing an immune response; contact spread did not occur with another mesogenic strain, Roakin.

A method is proposed for numerically evaluating the pathogenicity of Newcastle disease virus for birds older than 4 weeks, by calculating the intravenous pathogenicity index (IVPI) following either intravenous or intramuscular inoculation of virus.

These studies have defined some limitation of tests for vaccine; they have re-emphasized the need for careful control, not only of the virus constituting the Newcastle disease vaccine but of the health or condition of birds used for testing vaccines for purity, safety, and potency.

110 pages. $1.50. Mic 57-208

HEALTH SCIENCES, PUBLIC HEALTH

AN ANALYSIS OF CHARGES INCURRED FOR IN-PATIENT CARE IN GENERAL HOSPITALS; IMPLICATIONS FOR PROTECTION AGAINST THE COST OF HOSPITAL CARE

(Publication No. 19,683)

Howard Lee Bost, Ph.D.
University of Michigan, 1956

The purpose of this study is to find what expenses hospitalization entails for bed patients in general hospitals; and from analysis of the amount, composition, and distribution of these costs, to ascertain the implications on consumer financing of hospital care. Such information and its implications bear particularly on the provision of prepaid protection for individuals and families against the risk attributable to the cost of the hospital services they may require in the event of hospitalized illness.

To provide perspective in viewing the problem of financing hospital care, the current trend of consumer expenditures for hospital services is analysed with attention focused on factors affecting the magnitude of expenditures and the burden these costs impose on consumers. For study of hospital charges incurred by bed patients, a sample was obtained consisting of 7,669 patients drawn with a variable rate of sampling from a frame of 62,246 patients discharged from nonfederal general and special short-term hospitals in Michigan during 1951 and 1952. The data utilized consisted of detailed information on charges to patients reported to Michigan Hospital Service by the hospitals participating in this Blue Cross Plan, which covers almost half of the population of the state of Michigan. These data were initially provided by the Plan to the Commission on Financing of Hospital Care.

In the study, the distributions of charges for hospital care are analysed, for maternity and nonmaternity patients separately, by length of hospital stay and amount of expense incurred for the various items and classifications of services comprising hospital care. The extent of variations among patients is determined and the characteristics of the distributions are examined and interpreted. The principal factor related to the amount of charges

incurred by patients is found to be the length of hospital stay, but there are wide variations among patients with the same length of stay. Although it is found that charges for room and board service represent more than half of the total cost incurred for hospitalization, combined charges for all ancillary services are the major component of hospital expense for patients hospitalized for stays of relatively short duration.

The findings of the study point to the conclusion that the magnitude and distribution of hospitalization costs are such that payment by patients at the time services are provided is an unsatisfactory if not unworkable method of financing hospital care. To effectively meet the problem of payment for the increasingly important and costly services rendered by general hospitals, prepayment is seen to be essential both for the security of individuals and families against the cost of hospitalization and for the assurance of adequate financing of the provision of services.

An important factor in the effectiveness of prepayment for hospital care is seen to be the design of benefit provisions under arrangements for prepaid protection. The conclusion from the study is that among the principal existing approaches to the design of benefit standards, the indemnity-benefit approach is the least suitable and the service benefit approach the most suitable for accomplishing the purposes of prepayment arrangements.

Use of information derived from the study to acquaint individuals and families with the financial risk to which they are exposed with respect to hospitalization is seen to be a much needed application of the findings. The results have further practical application as a guide to purchasers of prepaid protection. A method for appraisal of the effectiveness of benefit provisions is developed and the findings of the study are converted to a basis designed to assist consumers in making informed choices when selecting prepaid hospitalization provisions for purchase from the numerous kinds and levels of benefits currently offered by the wide variety of prepayment and insurance organizations. 206 pages. $2.70. Mic 57-209

PUBLIC INSTITUTIONAL CARE FOR THE MENTALLY ILL IN ALLEGHENY COUNTY, PENNSYLVANIA, 1850 TO 1900

(Publication No. 19,629)

Jack Curry Greenawalt, Ph.D.
University of Pittsburgh, 1956

The purpose of this study was to examine and describe the type of public institutional mental care available in Allegheny County, Pennsylvania, between the years 1850 and 1900.

The historical-documentary method of research was utilized. The data analyzed consisted mainly of the records and reports of local hospitals, almshouses, prisons, city, county, and state public health authorities, and state and local legislation relating to mental care. Information from these sources was organized into a descriptive account of mental care in Allegheny County, comparing it to some degree with that offered elsewhere in Pennsylvania and other states as reported in the general psychiatric literature of the period.

Allegheny County housed its mentally ill almost exclusively in private homes, jails, and almshouses until mid-nineteenth century. No hospital facilities of any description existed in the county before 1847 and no mental wards until 1853 when the Western Pennsylvania Hospital opened its psychiatric department with space for about 30 patients. The hospital was founded and operated by a combination of private philanthropy and state aid.

The mental division expanded rapidly. Some ten years later, at the suggestion of Dorothea Lynde Dix, it was moved outside the city limits of Pittsburgh to a site named Dixmont in her honor. Here, by 1890, the department had expanded into a 585-bed institution and yet it was constantly overcrowded (attempting, for example, in 1900, to accommodate 832 patients in quarters planned for 585).

Psychiatric care at Dixmont was primarily "moral treatment," the prevailing therapeutic approach favored in many American and European asylums in the last century. Supplementing this was the extensive use of drugs, chiefly for purposes of sedation, thus minimizing the need for mechanical restraints for unruly patients.

Concurrently with the growth of Dixmont, both the Pittsburgh almshouse and the Allegheny City almshouse enlarged their mental sections. These institutions served indigent chronic mental cases and ordinarily provided simple custodial care. This remained true until late in the 1890's when the Commonwealth offered to subsidize part of the costs involved if counties would consent to expand their psychiatric facilities to include therapy, thereby helping to diminish the census of state mental hospitals which were extremely overcrowded, principally with long-term chronic cases. Taking advantage of this offer, another local institution, the Allegheny County almshouse, erected a mental department, increasing the county's public mental institutions to four. Each institution in the Commonwealth accepting aid was required to conform to the regulations established by the Pennsylvania Board of Public Charities' Committee on Lunacy and in this way at least a modicum of uniformity existed among many of the mental establishments throughout the state.

Among the conclusions reached in this study were the following:

1. The history of mental care in Allegheny County in the nineteenth century proved to be primarily the history of its mental institutions.
2. The nature of the majority of instances of mental care offered locally was simply custodial.
3. "Moral treatment" of mental illness was available, especially at Dixmont, and it was a lasting contribution of nineteenth-century psychiatry wherever it was practiced.
4. Local mental institutional directors were able administrators, for the most part, but they failed to make any noteworthy contribution to psychiatric research or therapy or to the literature of the field.
5. Allegheny County's mental institutions ranked highly when compared with similar organizations in the state but Pennsylvania's mental care generally rated about "average" in relation to that available in other states.

226 pages. $2.95. Mic 57-210

HISTORY, MEDIEVAL

THE CONFLICT OF PAPAL LEADERSHIP IDEALS FROM GREGORY VII TO ST. BERNARD OF CLAIRVAUX WITH SPECIAL REFERENCE TO THE SCHISM OF 1130

(Publication No. 19,727)

Hayden V. White, Ph.D.
University of Michigan, 1956

This thesis attempts to outline and analyze the values effecting the formulation of papal leadership ideals from 1059 to 1153. By outlining the changes which take place concerning leadership ideals in the articulate body of the Church during this period one can make clear the differences which held in the values of the Gregorian and the Cistercian reforms. It is argued that the latter are profoundly different from the former, that they are, in fact, a reaction to the former. The schism of 1130 is the event by which the Cistercians seize control of the leadership mechanism in Rome and install their own representative on the papal throne.

The literature of the period is divided into three parts. These are (1) the pre-Gregorian, (2) Gregorian and (3) post-Gregorian or Cistercian. The literatures are examined in an attempt to discover what individual writers consider to be the ideal virtues of the leader and the relation of the personality of the leader to his office. The system of classification used was that devised by Weber, Troeltsch, Kluckhohn and Parsons. Leadership is either charismatic or official, the former being represented for the most part in monkish and ascetic writers while the latter is found to be representative of priests, canon lawyers and bureaucrats. The writings of Peter Damiani, Humbert of Silva Candida, the canon lawyers, the imperial partisans, biographers and pro-papal apologists of the period 1059 1153 fall into these categories. In period (1) the official and charismatic concepts of leadership are intermixed. In period (2) the official comes to predominate. Period (3) is characterized by a resurgence of the charismatic ideal as the Cistercians, reacting to Gregorian legalism, reassert the ascetic hierarchy of values. The pontificates of Paschal II and Calixtus II are given special attention. The former represents the open seizure of power by the papal curia in the name of Gregorian leadership ideals, while the latter represents the forceful reentry of the monks as an organized group into the direction of papal policy. The papal schism of 1130-38 is a counter-attack on the part of the curia to regain control of the leadership mechanism. The victory of Innocent II is a victory of reaction to Gregorianism, and this victory is signified in the composition of the De Consideratione by St. Bernard in which the papal office is shown to be a purely charismatic power based upon the ability of the individual pope to conform to ascetic values.

Thus, through an analysis of the values which dominate the concepts of papal leadership from 1059 to 1153, the thesis contributes to an understanding of the ideological issues of the schism of 1130-38, shows how schism was inherent in the composition of the Gregorian hierocracy, and demonstrates the development of schism from the reign of Urban II through that of Paschall II to Honorius II.

626 pages. $7.95. Mic 57-211

HISTORY, MODERN

STANISLAS LESZCZYNSKI: A STUDY IN THE ENLIGHTENMENT

(Publication No. 19,681)

Edwin Charles Blackburn, Ph.D.
University of Michigan, 1956

This dissertation is an analysis of one man, Stanislas Leszczynski (1677-1766), in the light of the eighteenth century. It is not primarily a biography, but rather a study of ideas. It is also limited, chiefly, to a consideration of Stanislas while he was Duke of Lorraine and Bar.

Chapter one takes up in brief detail the life of Stanislas. It covers his first venture on the throne of Poland and his overthrow, his subsequent wanderings and then his return to prominence with the marriage of his daughter to Louis XV of France. He subsequently was elected King of Poland again and on his overthrow, during the War of the Polish Succession, he received the Duchy of Lorraine and Bar. It was during the period that he was Duke of Lorraine that Stanislas received the accolades of the philosophes.

This acclaim by the philosophes is in one sense a logical outcome of the actions of Stanislas. However in many respects Stanislas seems to be in direct opposition to both the theory and practice of the philosophes. As an example, he is not only a practicing Roman Catholic, but also supports the Jesuits. Chapters two, three, and four take up the ideas and practices of Stanislas in the fields of government, religion, and society. These chapters point out the similarities and the disagreements that Stanislas had with the main stream of philosophes' thought.

Despite the differences that existed between the philosophes and Stanislas, the philosophes considered him as an example of a good ruler and in some respects he is characteristic of the age of the philosophes. One example is the approach that Stanislas has towards problems in general. He is interested in theory, but is not primarily concerned with the implementation of his ideas. This lack of concern with how to achieve a policy seems to be characteristic of the philosophes. However Stanislas can not be classified as a consistent follower of the philosophes, or what is usually meant by the term philosophes. Although he has characteristics that are considered typical of that movement, Stanislas is also typical in some respects of an older Europe, a Europe of the devotes.

Two general conclusions can be drawn from this study. One is that the philosophes were more conservative than their writings might indicate and the second is that the philosophes were inclined to be more subservient than is usually thought. According to their professions of faith the philosophes should have condemned Stanislas. The fact that he patronized the philosophes and encouraged men of letters seemed to have made more difference to the philosophes than his writings. 167 pages. $2.20. Mic 57-212

POLITICAL BACKGROUND AND FIRST GUBERNATORIAL ADMINISTRATION OF GIFFORD PINCHOT, 1923-1927

(Publication No. 19,623)

Joseph Albert Falco, Ph.D.
University of Pittsburgh, 1956

The efficient machine that had been devised by two generations of crafty politicians ceased to function suddenly with the death of Philander Chase Knox, Boies Penrose, and William E. Crow. Warring factions began to accuse each other of responsibility for the waste in governmental operations, extravagance attributable to lack of planning, irregularities in handling public funds, and deficits in the treasury leading to nonpayment of current expenditures.

It was, therefore, a combination of need for a change in leadership of the state government and Pinchot's recognition of the political opportunity for one who would initiate reforms that led to the candidacy of Gifford Pinchot in 1922. With full knowledge of the task that lay before him, Pinchot went before the people of Pennsylvania and promised that, if elected Governor, he would operate the government on a budget system, reorganize the state government, drive the saloons out of Pennsylvania, and give every man, woman, and child a Roosevelt Square Deal.

Pinchot established a "new order" in Pennsylvania, but not without opposition. Though the Legislatures of 1923 and 1925 were without a boss or leadership, the Governor had to exercise his political acumen and executive ability to obtain passage of legislation necessary to carry out his platform. By making public demands upon nominees to the Legislature for promises of support, withholding patronage, exercising his veto power, and threatening the lawmakers with a special session, Governor Pinchot was successful in obtaining from unfriendly and obstructing legislators the important pledges he made to his constituents.

The passage of the Administrative Code, which provided for the reorganization of the executive branch of government and the inauguration of Pennsylvania's first state budget, was Pinchot's most notable achievement. It weathered the storms of political factions and groups who were determined to discredit the program of the independent Governor.

In his efforts to enforce the Eighteenth Amendment, Pinchot sponsored the enactment of a law to abolish saloon licenses for the sale of beverages with the half of one per cent alcoholic content permitted under the Volstead Act. Although the new enforcement act was technically a success, saloons were not driven out of Pennsylvania, for they continued to flourish under a different name and without a state license.

Prompted by his characteristic policy of conservation and development of natural resources to the greatest benefit for society at large, Pinchot placed electrical power in the category of major agents for development in industrial, social, and economic growth. In his attempt to bring about the "most good for the greatest number," Governor Pinchot constructed nearly 3,000 miles of hard-surfaced "Pinchot Roads." A Roosevelt Square Deal was extended to the anthracite coal miners of Pennsylvania. Through the efforts of the Governor, satisfactory agreements were obtained for labor and its leaders during the labor disturbances of the anthracite miners.

The interim government of Gifford Pinchot marked the momentary disruption of machine politics in Pennsylvania. Completely devoid of political ties, the forward-looking humanitarian Governor ruled independent of the Republican organization. His aloofness gave the machine an opportunity to reorganize into a functioning unit under the leadership of Andrew Mellon and Joseph Grundy. Before Pinchot left office, the Republican machine took over the reins of government with Grundy's candidate in the governorship, and William Larimer Mellon as Chairman of the State Republican Committee. Consequently, the Administration of Gifford Pinchot marked but a brief interlude in the history of machine rule in Pennsylvania. Nevertheless, Pinchot towered above the rank and file of professional politicians of both parties in the Commonwealth.

341 pages. $4.40. Mic 57-213

THE AULA AND THE VIENNA RADICAL MOVEMENT OF 1848

(Publication No. 19,777)

Rolland Ray Lutz, Jr. Ph.D.
Cornell University, 1956

The chief aim of this work is to expand the traditional picture of the Vienna Aula of 1848. Hitherto, the Aula has been regarded as a student faction. This is a valid approach, but the Aula was much more than a student affair both in character and significance.

Published documents, newspapers, archival sources, and secondary works reveal that the Aula originated in a student movement and contained numerous students; but it soon became a gathering point for radicals of all descriptions: writers, artists, lawyers, petty officials, physicians, etc. In April, the students and adult radicals who made up the Aula movement were transformed into Austria's first modern political party. It had its local party units, the companies of the Academic Legion. Each company elected a representative to the directorate, the Student Committee, which made most of the policy decisions. Matters of great importance were submitted to a general party congress. If political action did not suffice, the Aula could back up its demands with steel; for in its military capacity, it was the famous Academic Legion.

The Aula was also Austria's first radical party. Its ideology was reducible to two main goals: the democratization of Austria, and Anschluss between Austria's German provinces and Germany at the earliest opportunity.

Of special importance was the relation between the Aula and the Vienna radical movement of 1848. In the earliest period of the revolution, the Aula and the Vienna radical movement were identical. Later, in May, the Aula cooperated with the National Guard to broaden the radical movement by creating a Political Central Committee. A split developed within this committee between liberals and radicals, and the Aula was able to use this cleavage to win control of the organization. When the Political Central Committee was succeeded by the United Committee in late May, this organization too fell under the domination of the Aula and its supporters. From early May till late August, the Aula was able to use these committees to direct the radical movement.

In July and August a new ministry, the Doblhoff-Bach ministry, succeeded in weakening and ultimately destroying the United Committee. Alexander Bach and his colleagues were able with the support of the Reichstag majority and the Vienna garrison to render the radical movement powerless by mid-September. During the last half of that month, however, the ministry injected new life into the radical movement by supporting the counter-revolution in Hungary.

An attempt to dispatch Viennese troops to Hungary brought armed resistance from the Academic Legion and plunged Vienna into a new, radical revolution. The October Revolution was directed jointly by the Aula and a left-wing rump of the Reichstag. The latter, however, left the leadership principally to the Student Committee. The Student Committee armed and organized the workers of Vienna; it negotiated with the Frankfort Parlament and the Hungarian government for military assistance; and during the last days of the revolution, it replaced the commanders of suburban Guard units with Academic Legionnaires. From March 13 till October 31, the Aula was the heart and soul of the Vienna radical movement of 1848.

In spite of the power which the radicals wielded, their movement failed. It failed chiefly because the radicals subordinated their political ideals to their Greater German ambitions and also because they invoked the aid of the urban masses. Faced with the possible dissolution of the Habsburg empire and with the threat of social upheaval, the bulk of the Austrians became either indifferent to the revolution or they rallied to the support of the counter-revolution. 193 pages. $2.55. Mic 57-214

THE DODECANESE ISLANDS: A STUDY OF EUROPEAN DIPLOMACY, ITALIAN IMPERIALISM AND GREEK NATIONALISM, 1911-1947

(Publication No. 18,654)

Stephen Louis Speronis, Ph.D.
University of Michigan, 1956

This dissertation is devoted principally to the study of the nationalism of the Dodecanese Islanders and its proper relationship to international affairs. The Dodecanese are a group of fourteen islands located off the coast of Turkey and although unimportant economically, are of considerable value strategically, since they lie close to the Straits of Dardanelles. The Introduction presents the historical background of the Dodecanese to the Ottoman conquest of 1522. The autonomy of the Dodecanese is then discussed and weighed in terms of its influence on the continuity of native institutions in the islands. The Turks, by permitting the Dodecanesians to enjoy the privilege of local autonomy, to apply their own political system and to practice their religion freely, unwittingly contributed to the strength of an already dominant sense of pride in Greek customs, traditions, and race.

Chapter I deals with the rise of nationalism in the Dodecanese. Here Russia, in the persons of Catherine II and Alexander I, played an important role. Great Britain then entered the scene during and after the Greek independence effort, and along with France and Russia, acted as guarantor of the autonomy of the islanders. As the result of the Young Turk Revolution of 1909, the Turkish Government made a belated attempt to denationalize the islands and weave them completely into the new Ottoman fabric. This effort was, however, doomed by the Italian occupation of the islands on May 12, 1912.

Chapter II deals with the Italian occupation of the Dodecanese and the high politics of the period 1912-1914. Italian efforts to hold these islands and the opposition offered to this program by the Powers are the two main currents affecting the Dodecanese during this phase of their history. The Dodecanesians repeatedly demonstrated their wishes to join Greece, and with the outbreak of World War I, Italy was left in possession of them until 1919.

Chapters III and IV deal with the conflict of ideas in the Aegean from 1914 to 1919. The islanders eagerly supported the aims of Hellenism as against those of Italy's program of sacro egoismo. Giolitti, who had expressed fear of a rising feeling of Hellenic irredentism in the Aegean, now saw it come to pass. The Entente Powers reluctantly gave their consent to the London Treaty of April 26, 1915. Moreover Italy's policy during the course of the war appeared to be an attempt to divide the Greek Government and prevent Venizelos from entering the war on the Allied side. Greek suspicions of Italian ambitions in the islands grew in intensity and by 1919 the Hellenic Government was convinced that Italy was there to stay. In spite of two separate agreements made with Italy, Venizelos was unable to achieve his goal of uniting the Dodecanese with Greece.

Chapter V is concerned with the Lausanne Conference and the period to the Second World War where the Dodecanesians reached the nadir of their fortunes when they were annexed by Italy. Subjected to a policy of Italianization and expropriation, the islanders, with the direct help of their brethren in Greece, succeeded in holding their own.

Chapter VI, the final chapter, is concerned with the Paris Peace Conference of 1946 and the union of the Dodecanese with Greece. On March 31, 1947, the Greek Government took over the administration of the islands and began a program of reconstruction.

Two general conclusions can be drawn from the study. First, the strength of the native culture of the Dodecanesians and their alertness to hold to their autonomy aided them in their drive for independence. Secondly, the support of the Great Powers encouraged the islanders and helped them achieve their desire for union with Greece.

260 pages. $3.35. Mic 57-215

THE VERMONT PROBLEM IN THE CONTINENTAL CONGRESS AND IN INTERSTATE RELATIONS, 1776-1787

(Publication No. 19,720)

Winn Lowell Taplin, Jr., Ph.D.
University of Michigan, 1956

This study deals with the political relations of the Vermont republic with its neighboring states and the Continental Congress from the start of the War of Independence to the framing of the Constitution. It traces the complex pattern of Congressional action on the Vermont problem and the manner in which it affected other Congressional activities. Most other aspects of early Vermont history--the colonial struggle for the area, Vermont's negotiations with the British, and the economic and geographic aspects of Vermont policy--have been dealt with thoroughly. All the previous work on Vermont's early political relations with the United States, however, has been from a local viewpoint.

Numerous manuscript depositories and published collections of primary materials have been utilized. In presentation a chronological approach has been followed. Certain specific subjects, however, have been handled topically in order to retain unity.

Most of the complication of the issue came directly or indirectly as the result of land speculation. The problem originally sprang from a colonial fight for the New Hampshire Grants between speculative interests in New York and their counterparts who held conflicting New Hampshire titles, and this contest continued through the War of Independence. When the Grants became independent Vermont, their struggle for recognition became seriously entangled with the western land problem which itself was based on speculation. In addition, Vermont shrewdly created its own speculative interests by judiciously granting lands to influential persons throughout the United States, including members of Congress and officers in the Continental Army.

In Vermont, the complexity of the issue was demonstrated by the diverse groups anxious to control the area. The three neighboring states--New York, New Hampshire, and Massachusetts--had supporters there, but there were two even stronger groups which had no close ties with any established state: the Vermonters who were trying to create a new independent state and the College Party which was willing to affiliate with any jurisdiction which would comply with its demand that the Connecticut River Valley be united. Each of these contending local groups sought to gain Congressional sanction and their efforts in turn brought the problem into association with other more general problems of the Confederacy. The traditional antagonism between New York and the New England states was intensified, questions concerning the power of Congress were raised, the strategic position of the Continent was complicated, and the back country vs. seaboard struggle was emphasized.

The Vermont problem, however, was never solved by the Continental Congress. This revolt within a revolt was too much for its sketchy powers and internal jealousies. Even though Vermont successfully established its independence, it was only when a new framework of government was created that the United States was sufficiently strong to bring about Vermont's admission as the fourteenth state. For the Vermonters the struggle for recognition, won through a combination of adroit leadership and good fortune, was long and hard one, while for the Continental Congress it was a humiliating experience demonstrating the weakness of that body. 327 pages. $4.20. Mic 57-216

HOME ECONOMICS

AN ANALYSIS OF THE HOME ECONOMICS TEACHER EDUCATION PROGRAM IN THREE MICHIGAN COLLEGES

(Publication No. 19,063)

Marquita L. Irland, Ed.D.
Wayne University, 1956

Adviser: Charlotte W. Junge

One of the greatest and most immediate needs in education today is the adequate staffing of our nation's schools by competent teachers; a part of this problem, namely, the holding power of the home economics education major as it is reflected in the acute shortage of homemaking teachers in Michigan provided the inspiration for this study. The present study is only one of numerous possible approaches to determine some of the reasons why individuals enter the home economics education major, why they remain in the major to graduate (or drop out), and what graduates of the major are doing to encourage others to follow in their professional footsteps.

Procedure

To gain some insight into the preceding questions, it was decided to study home economics teacher education programs in three Michigan colleges which were considered to be representative of the thirteen institutions in the state preparing homemaking teachers.

The procedures used to carry out this study involved the development of a questionnaire for use by the currently enrolled majors in home economics education (Juniors and Seniors), the girls who had dropped out of the major within the last two years (1953-55), and graduates having completed their work during this same period who were currently teaching homemaking. In addition each teaching graduate was invited to administer a high school questionnaire to students in one homemaking class.

Involved in this study were 119 currently enrolled majors, 33 dropouts, 46 teaching graduates, and 955 high school students.

The questionnaire to the college girls, dropouts, and teaching graduates included such items as: home community, years of high school homemaking taken, 4H club membership, experiences with children, inspiration for

becoming a homemaking teacher, student teaching experiences, discouraging courses, desirable electives, laboratory classes, and professional education courses. Still other questions were aimed at concerns about the method of instruction, personnel, and counseling.

The high school questionnaire requested certain background information about the student as well as reactions to their current homemaking class.

Findings

The data collected in this study support to some extent a number of frequently quoted beliefs about homemaking teachers, college students, and high school girls; however, several long standing beliefs are not borne out by the study.

A. Aspects of the program

Girls who enter the home economics education major generally speaking expect to complete requirements for graduation. They feel that the length and number of laboratory classes is discouraging, that too few electives are permitted, and that the required professional education courses are too theoretical. Some concern was evidenced regarding the adequacy of the student teaching experience and the counseling provided.

B. Dropouts

Science courses and the lack of elective hours rate highest with dropouts as discouraging them from continuing in the major. The dropouts, like the currently enrolled majors and graduates, indicated that their parents and a homemaking teacher had inspired them to become a homemaking teacher. The dropouts generally have not had 4H club experience, about one fourth of them have not taken high school homemaking, and they average fewer experiences per person with children than the overall group.

Dropouts reporting in this study have transferred to other college majors so are still in school but completing their work in another area of study.

C. Recruitment

Home economics teacher education majors come from cities as well as smaller communities, and the largest percentage have had two years of high school homemaking. High school classes are reported as being interesting, but most of the information is not new to the students; they are still predominantly foods and clothing classes.

This study is only one of many being done of education programs throughout the country. It represents, in the author's opinion, a changing area worthy of continual investigation by many individuals if the homemaking teacher shortage and dropouts among teaching majors is to be met realistically. 121 pages. $1.65. Mic 57-217

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

HEROIC AND SENTIMENTAL ELEMENTS IN THOMAS OTWAY'S TRAGEDIES

(Publication No. 19,679)

Hazel Margaret Batzer, Ph.D.
University of Michigan, 1956

The purpose of this study has been to arrive at a comprehensive understanding of the significance of Thomas Otway's tragedies in the development of the drama of sensibility. The investigation has involved definition of the drama of sensibility, recognition of Otway's artistic milieu and analysis of his tragedies.

The first problem considered is the extent to which Otway's tragedies are conceived and executed in accordance with conventions of heroic drama. Considered in conjunction with this is the problem of whether Otway's tragedies as a whole fit into the framework of the drama of sensibility. Examination is made of individual plays to determine to what extent heroic and sentimental elements are an integral part of the emotional structure and disposition of plot and to what extent such elements possess a coherence that indicates that Otway is consciously using themes and expressing attitudes of the heroic or consciously breaking away from the heroic and developing a new kind of drama.

The results of the study indicate that Otway's position in Restoration drama is transitional; his tragedy points backward to heroic drama and forward to sentimental drama. Otway seems to have tried to compose Alcibiades according to heroic convention but to have been unable to express himself in heroic language with any measure of ease and cogency or to produce the spirit and sentiment of heroic drama. In both Alcibiades and Don Carlos, dramatically significant borrowings from heroic drama are of pathetic situations rather than of heroic action that is governed by the love and honour conflict. Focus is upon the sufferings of the sympathetic hero and heroine who are involved in essentially domestic problems. There is indication of indebtedness to Shakespeare. There seems also to be conscious emulation of Racine's appeal to pity. Titus and Berenice revelas Otway working under the influence of Racine and merging the man of heroic virtue, the man of heroic magnanimity and the man of sensibility. Otway's sense of dramatic conflict deepens, but he still accents sentimental elements of heroic drama or sentimentalizes elements of sensibilité, tendresse and pathétique from Bérénice. Under the direct influence of Shakespeare, in Caius Marius, Otway develops his own creative powers more surely and freely than he has under the influence of the heroic or Racine. In Caius Marius, he achieves emancipation from the heroic and also avoids the extravagances of both heroic and sentimental drama. In The Orphan and Venice Preserv'd, finally, neither the basic dramatic situation nor the unfolding action is informed by heroic sensibility. Appeal is made to intimate personal emotions rather than to heroic issues. The nature of the hero is not heroic; instead it is that of the "Man of Feeling".

Otway's characters provide well developed prototypes for the representative "Man of Feeling" of the eighteenth century. The sentimentalism of his plays is in line with

a general semi-popular movement in the direction of sentimentalism from 1660 onward. Themes which dominate the so-called drama of sensibility of the eighteenth century are already prevalent in Otway's tragedies: the obligations of friendship, filial obedience or piety, the operation of a special divine providence, sympathizing nature, innate goodness or perfectibility of man's nature, magnanimity which becomes benevolence and the reformative power of virtue. The psychology of the "Man of Feeling" and the philosophy of sentimentalism seem coherently developed in Otway's tragedies by 1680 and 1682. His last tragedies, The Orphan and Venice Preserv'd, may be considered full-fledged drama of sensibility.

378 pages. $4.85. Mic 57-218

THE CHESTER PLAYS: INTERRELATION OF MANUSCRIPTS

(Publication No. 18,573)

Bernice French Coffee, Ph.D.
University of Missouri, 1956

Supervisor: Hardin Craig

The purpose of this dissertation is to determine the interrelation of the Chester plays in MSS Devonshire (D), British Museum Add. 10305 (W), British Museum Harley 2013 (h), Bodleian 175 (B), and British Museum Harley 2124 (H). Criteria selected for estimating the manuscript closest to an original are these: (1) archaic language and Middle English grammatical constructions; (2) syllabic meter in the ballad stanza, a modified form of the rime couée, in which the plays were originally composed; (3) logical meaning as opposed to illogical substitutions that reveal the hand of a redactor; and (4) liturgical content as compared to secular.

This study reveals that Harley 2124 (H), which bears the latest date, is the oldest text and the closest to an original. In the use of a more archaic vocabulary, in the retention of a purer meter, and in the preservation of a more intelligible meaning, H is consistently an earlier text than are DWhB. Older inflectional endings used in H have disappeared in the older texts, which show tendencies of modernization. Also, H adheres more strictly to the liturgy than do DWhB, in which the departure from the earlier church drama is conspicuous in some plays. For example, Play V in H is an Ordo Prophetarum, resembling the Benediktbeuern Christmas Play, the latest of the Latin dramas that had an Ordo Prophetarum. In DWhB the Messianic Prophets have disappeared and the scene of Balaam and the speaking ass has grown into a Balaam and Balak play.

The close kinship of DWhB is revealed in their common errors and emendations. Since H does not make the errors of these texts, it does not belong to their family group. DWhB are not descendants of H, but spring from a later ancestor that may be called beta. Although DWhB have many like characteristics, no one of the group seems to be a copy of the other; for each has peculiarities not shared by any other text.

Of the group, D shows the greatest likeness to H, although B is a close competitor. In eleven plays, D is of more kinship to H than are any of the other manuscripts. These plays are II, VII, IX, XIV, XV, XVII, XIX, XXIII, and XXIV. This grouping does not take into consideration Play XII, in which D and h are equally related to H, or Play I that has been lost from D. The spelling and other linguistic features of D appear older than those of WhB. Of next kinship to H is B, which also has eleven plays that more nearly correspond to H than do DWh. These plays are I, III, IV, V, VIII, X, XI, XIII, XVI, and XXI. In Play XVI, B agrees with H in twice as many lines as does any other manuscript.

W and h contain more modernizations and are more alike than any other two manuscripts. However, George Bellin, the scribe of both, seems not to have used W in its entirety as a copy for h. In Plays II, IX, and XXI, h has lines that are not in W. On the other hand, W has lines in Plays IX, XXIII, and XXIV that do not appear in h. That Bellin had access to an older manuscript when he wrote h is indicated by Plays XII, XV, and XVIII, in which h shows a closer relation to H than do DWB. However, h always retains characteristic features of its companion W.

639 pages. $8.10. Mic 57-219

THE LIFE OF VICENTE ESPINEL AND ITS REFLECTION IN HIS WORK

(Publication No. 19,526)

George Haley, Ph.D.
Brown University, 1956

Part I of this study is a chronological reconstruction of the life of Vicente Espinel from contemporary materials. It may be considered a corrected and enlarged version of Juan Pérez de Guzmán's essay, "Vicente Espinel y su obra," which appeared as the Introduction to his edition of Espinel's novel, Vida del escudero Marcos de Obregón (Barcelona, 1881). This documentary study incorporates such published work as has appeared since Pérez de Guzmán issued his work. It utilizes many new documents in addition to offering more complete information from those Pérez de Guzmán had consulted. The autobiographical passages in Espinel's collection of verse, Diversas rimas (Madrid, 1591), are also included, but, because of the special problems involved, Marcos de Obregón is considered by itself.

Part II of this study then examines the novel in the light of the accurate biographical information now available. It has long been generally conceded by critics that the framework of Marcos de Obregón is the life of Vicente Espinel. But none has systematically studied the novel to determine in what way and to what an extent this is true. Because of its dual nature, historical and fictional, Marcos de Obregón presents a biographical problem that does not occur in Diversas rimas. In his verse collection, Espinel sought self-expression directly. But in Marcos de Obregón, there is an element of conscious fictionalizing that masks the author behind a character who must maintain the novel as well as evoke the life of the author. Part II attempts to determine the relationship between Vicente Espinel and his literary creature, and to identify the autobiographical elements in the work. This investigation entails a consideration of various matters of literary theory and technique.

The two parts of this study complement each other. By proceeding from Espinel's revised biography to an examination of Marcos de Obregón, a clearer and more accurate picture of both his life and literary creation is achieved. This picture had been distorted by those who, including Pérez de Guzmán, had used the novel indiscriminately as a source-book for the biography of Espinel without taking into sufficient account its fictional dimension.

This study is supplemented by 33 Appendixes containing a collection of documents, many of them hitherto unpublished, relating to the life of Vicente Espinel.

315 pages. $4.05. Mic 57-220

CARMONTELLE, PEINTRE SATIRIQUE DES MOEURS DES DERNIÈRES, DÉCADES DE L'ANCIEN RÉGIME

(Publication No. 18,010)

Marie-Louise Lagarde, Ph.D.
Tulane University, 1956

Louis Carrogis, dit Carmontelle (1717-1806), malgré son origine obscure, se fit connaître dans les salons du dixhuitième siècle comme peintre, auteur et dessinateur de jardins. Il fut lecteur du duc de Chartres, et plus tard, il fut régisseur-général des fêtes du duc d'Orléans Dans ce milieu presque royal il a présidé jusqu'à la Révolution à l'organisation de toutes les fêtes. Modeste et charmant, il esquissait de jolis pastels, traçait à la plume des portraits d'une ressemblance parfaite, et se spécialisait dans les "transparents," mais son genre de prédilection restait le proverbe dramatique. Il en faisait un cadre aisé à d'innombrables tableautins d'une touche un peu sèche, mais spirituels et pris sur nature.

Pendant les années de 1760 a 1789, une véritable "théâtromanie" avait saisi toutes les classes de la société, surtout le grand monde. Carmontelle a profité de cette manie pour exprimer en forme dramatique ses opinions sur tous les aspects de la vie de son temps. Préparé par son expérience et doué comme il était, notre auteur se trouvait bien qualifié pour dépeindre les moeurs de la fin de l'Ancien Régime. Puisqu'il a vu de près les personnages qu'il dépeint dans ses comédies, il reproduit avec une vérité étonnante les manières des cercles qu'il fréquentait dans tous les milieux de la société parisienne.

Il est difficile de comprendre qu'un auteur dont les talents étaient si répandus pendant son temps, ait laissé si peu de traces de sa vie personnelle, ou que son travail littéraire soit si ignore de nos jours. Car, aujourd'hui nous connaissons Carmontelle presque uniquement comme artiste à la gouache. Comme auteur dramatique il est inconnu, excepté à quelques historiens de littérature ou à quelques personnes qui s'intéressent aux curiosités littéraires. Pourtant, Carmontelle a une grande importance pour ceux qui étudient les moeurs du dix-huitième siècle. Comme auteur des proverbes il a laissé plus de trois cents petites pièces, sans oublier les recueils manuscrits, qui forment un tableau exacte des moeurs de toutes les classes de son temps.

En vue de la position que tenait Carmontelle dans la société de son époque, de la vogue de ses proverbes, et de leur valeur comme document sociologique, l'oubli dans lequel sont tombées ses petites comédies est peu justifié. Son oeuvre n'est pas de premier ordre du point de vue littéraire, mais cela ne diminue pas la valeur des détails que nous donnent ses pièces sur les moeurs des dernières années de l'Ancien Régime.

Puisque l'oeuvre de Carmontelle est si ignoré aujourd' hui, nous avons voulu montrer que l' ensemble de ses petites pièces a une valeur réelle qui ne dépend pas nécessairement de son mérite littéraire. Les divisions principales de notre étude sont les suivantes: (1) Biographie; (2) Divertissements; (3) D'autres passe-temps; (4) L'Intérêt personnel; (5) La Mode, et (6) Le Préjugé à la mode et le mariage.

Les renseignements sur la vie de Carmontelle étant épars et incomplets, nous nous sommes permis dé devouer le premier chapitre à une biographie de l'auteur. Dans les chapitres qui suivent nous considérons dans l'oeuvre de Carmontelle les côtés de la vie qui nous semble les plus représentatifs de l'époque à laquelle il écrivait.

La comparaison du tableau de la société que fait Carmontelle avec celui que nous ont laissé ses contemporains prouve la vérité des détails que nous donne les petites pieces de notre auteur. D'ailleurs, l'exactitude du tableau nous est certifiée par beaucoup de détails historiques.

Puisque nous croyons que la vraie valeur d'un oeuvre comme celui de Carmontelle consiste en sa reproduction exacte de l'époque à laquelle l'auteur vivait, nous croyons qu'un oeuvre de cette sorte peut être étudié avec profit, premièrement pour sa valeur documentaire, et deuxièmement pour sa valeur littéraire et dramatique. Nous croyons que la conclusion à laquelle nous sommes arrivés est justifiée: Carmontelle fournit sur son époque un document que sa minutie et son ampleur rendent singulièrement précieux. Des notes qu'il a laissées se dégage un portrait curieusement authentique: l'image et l'âme d'une société.

422 pages. $5.40. Mic 57-221

EL PRÍNCIPE DON CARLOS OF DIEGO XIMÉNEZ DE ENCISO: A CRITICAL EDITION WITH INTRODUCTION AND NOTES (PARTS I AND II)

(Publication No. 18,817)

Frank Thomas Platt, Ph.D.
The Ohio State University, 1956

El príncipe don Carlos, by Diego Ximénez de Enciso (1585-1634), has been acclaimed in the past as one of the best historical dramas of the Golden Age of Spanish literature. Modern scholars, on the whole, have unaccountably neglected it. Moreover, no reliable edition of the play has been published. Enciso's masterpiece deserves a better fate.

In the preparation of the present critical edition the following manuscripts and editions of El príncipe don Carlos have been consulted and collated: MSS 15.554, 17.407, and 16.684 in the Biblioteca Nacional (Madrid); MSS CC*, IV, 28.033, vol. LXXXI and CC*, IV, 28.033, vol. LXXI at the Biblioteca Palatina (Parma); a manuscript copy made by the German scholar Adolph Schaeffer at the Universitätsbibliothek (Freiburg); the editions of Huesca, 1634; Madrid, 1667; Valencia, 1773; an undated

suelta; and a modern edition by Juan Hurtado y Jiménez de la Serna (Madrid, 1925). We have based our text on MS 15.554, justifying our emendations and recording variants.

In the Introduction we deal with sources, the date of composition (between 1621 and 1628), critical studies of Enciso and our play; we describe the MSS and editions listed above, and organize them in a stemma; we compare Enciso's treatment of the Don Carlos theme with that of other Spanish dramatists of the period; finally we attempt a critical evaluation of Enciso's play.

In the Notes we compare Enciso's style in El principe don Carlos with that of his other plays, elucidate linguistic difficulties, and explain the historical background. In the Appendix we include passages from the sources employed, and we summarize the eighteenth century refundición of José de Cañizares. Enciso's other plays, and studies on El príncipe don Carlos and the theatre of the period, are included in the Bibliography, as are all the other works utilized in the preparation of this dissertation. An Index to words documented in the Notes completes this study.

El príncipe don Carlos, the first dramatic treatment of the Don Carlos theme, is distinguished by its adherence to historical facts, its sobriety and clarity of style, its dramatic unity and excellent characterization. It is surely one of the greatest historical dramas of the Golden Age, comparing favorably with Guillén de Castro's Las mocedades del Cid, Lope's Fuenteovejuna, and Tirso's La prudencia en la mujer. It re-creates the very spirit of history and the personalities of the people who made it.

472 pages. $6.00. Mic 57-222

A STUDY OF CERTAIN NOTEBOOKS AND MANUSCRIPTS OF FRANCIS THOMPSON IN RELATION TO HIS POETIC THEORY AND CRITICAL PROCEDURE

(Publication No. 19,546)

Paul van Kuykendall Thomson, Ph.D.
Brown University, 1956

This study makes use of many unpublished documents from a collection of Francis Thompson's notebooks and manuscripts belonging to the library of Boston College. Divided into four sections, it analyzes the philosophy underlying Thompson's theory of poetry; his concept of the creative process; his definition of the essence of poetry and of its unique values; and the tone, motivation, and quality of his criticism.

The first section points out that although he carefully distinguished between poetry and mysticism, Thompson saw significant parallels between the psychology of mystics and poets. He is seen as sharing the tradition of Christian Neo-Platonism with Patmore, and as having had an intuitive conviction that man and nature are analogues of God. Thompson's private expressions of this philosophy are analyzed, as well as his belief that the justification of metaphor must rest upon a universal system of correspondences. This belief is shown to have been closely related to Thompson's examination of the multiple meanings of such universal symbols as the sun and water. Particular attention is given to Thompson's notes on Swedenborg's symbolic system, and his interest in esoteric works is shown to have been motivated by his belief that poets must counteract the evils of exclusive materialism by restoring man's awareness of the divine idea underlying external things.

The second section attributes Thompson's preoccupation with the creative process to the tension between his deep introversion and his intense desire for expression. It demonstrates how Thompson believed that the poet, like the contemplative, must undergo times of withdrawal, traditional disciplines, and periods of dryness and passive attention, before coming to rare moments of inspired insight. Thompson is shown to have been influenced by Coleridge's account of the psychology of creation, and by the psychological theories of Wordsworth and Shelley as well. He is seen as giving emphasis to the poet's need for inspiration and passion, but, at the same time, Thompson's awareness of the laborious struggle for integrity of expression is brought out through an examination of his first rough draft of "Orient Ode," which is taken as typical.

In the third section, Thompson's insistence upon the belief that poetry is not primarily concerned with the statement of ideas is linked to his opinion that there is no special poetic subject matter, just as there is no peculiarly poetic vocabulary. Thompson's appreciation of the fact that the study of the essential nature of metre brings one close to the essence of poetry itself is discussed, and his understanding of the importance of the psychology of rhythm, as well as the roles of stress and temporal variation, is emphasized. Thompson is shown to have shared Coleridge's doctrine of organic wholeness as the supreme poetic value, and to have defended the utility and worth of aesthetic experience against the contempt of practical materialists and the neglect or suspicion of his coreligionists. The section concludes that while Thompson recognized poetry's dependence upon moral law, he also contended that the ends of poets, prophets, and saints must not be confused.

The concluding section presents an analysis of the ironic wit that appears in Thompson's criticism, and shows it to have been an important cause of the balanced tone of many of his critical appraisals. His intuitive, impressionistic approach to critical problems is described, and it is pointed out that his regard for any genuine poetic achievement prevented him from using criticism as a vehicle for religious controversy or literary factionalism. Thompson's position with regard to the main currents of Victorian critical thought is given, and he is seen to represent a happy mean between didacticism and pure aestheticism.

196 pages. $2.55. Mic 57-223

LANGUAGE AND LITERATURE, LINGUISTICS

THE MID-BACK VOWELS IN THE ENGLISH OF THE EASTERN UNITED STATES: A DETAILED INVESTIGATION OF REGIONAL AND SOCIAL DIFFERENCES IN PHONIC CHARACTERISTICS AND IN PHONEMIC ORGANIZATION

(Publication No. 19,677)

Walter Spencer Avis, Ph.D.
University of Michigan, 1956

The status of the mid-back vowels in the English of the Eastern United States is the subject of this dissertation. The primary source materials for the study are the field records of the Linguistic Atlas of the United States and Canada, as representing the speech of over 1,400 informants in some 700 eastern communities. These collections, including about ninety for Southern England, were made during the past two decades under the auspices of the American Council of Learned Societies and are presently housed at the University of Michigan.

The method of investigation consisted in first charting for the entire area the phones occurring in some twenty key words (e.g., road, sofa, know), a procedure which established the main areas of concentration for the principal types, revealing (1) that the upgliding diphthong [oU] is the predominant phonic type and (2) that the non-upgliding types [oə/o] occur prominently in the Low Country of South Carolina and in Eastern New England, both of which areas are treated in detail. In each of these areas the phones in some 150 relevant words have been charted, their phonemic status established, and the positional and prosodic allophones of the phoneme or phonemes described. A detailed analysis of dissemination is presented, showing the incidence of the different allophones and/or phonemes in the vocabulary and pointing out regional, social, and individual differences in usage. From this analysis conclusions are drawn as to the degree of recessiveness of atypical pronunciations in each area. Throughout the study maps and tables are presented to enable the reader to check the generalizations and interpretations.

The results of the investigation may be summed up as follows: in all parts of the Eastern United States, except New England, there is one vowel phoneme /o/, which exhibits more or less marked regional phonic differences, being realized as [oU] in most areas, as [oə/o] in others, and as [o] in still others; here ME /ɔ:/ and /ɔu/ have coalesced into one phoneme. In New England, most obviously in the east, there are two distinct phonemes, /o/, realized as [oU], and /e/, realized as [eə/e], the former occurring always in word-final position and commonly in other positions, the latter under complex and markedly unstable conditions only before consonants in a limited number of words; here the above-mentioned ME phonemes have remained distinct, though the dichotomy is far from complete.

A comparison with the dialects of Southern England reveals that all of the phonic types found in American English are represented there. It must be assumed that in colonial days diversity existed within each colony, and from colony to colony, with the result that certain reflexes of earlier phonemes have been generalized in one area, others in another. At present in the Eastern United States the predominant upgliding [oU] diphthong is rapidly displacing the ingliding [oə] diphthong everywhere except in the Low Country of South Carolina, and even there indications are that the former is being adopted along the periphery of the area.

The investigation shows how complicated phonological development in America is when the linguistic feature concerned is one for which wide diversity exists in British English. Finally, it can be said that the investigation treats the problems of phonic and phonemic changes in American English in more detail than any previous study.

241 pages. $3.15. Mic 57-224

LANGUAGE AND LITERATURE, MODERN

WILLIAM ARCHER AS CRITIC OF MODERN ENGLISH DRAMA, 1882-1914

(Publication No. 19,684)

Paul Edward Cairns, Ph.D.
University of Michigan, 1956

The purpose of this study is to describe the scope, illustrate the quality, and appraise the significance of William Archer's criticism of modern English drama from 1882 to 1914. Archer, always interested in all phases of theatrical activity, in the eighties became primarily interested in the potentialities of native English drama as a social force responsive to new ideas and new techniques. The renascence in English drama Archer sees as having progressed through three consecutive periods: (1) that of Grundy, Pinero, and Jones, 1882-1888; (2) the period 1889-1901 when English drama felt the influence of Ibsen and the new continental drama; (3) the period before World War I when the "intellectual drama" of Shaw, Barker, and Galsworthy came into prominence.

When Archer began his London career in 1879, the contemporary English drama represented a low level of artistic and intellectual attainment, and, as a result, the theatre was largely despised or ignored by people of intellect. By applying the tests of reason and verisimilitude, Archer exposed the literary and dramatic poverty of the contemporary English drama and sought strenously to improve it. Urging English dramatists along the paths of more expert craftsmanship and stronger realism, Archer applauded the first tentative indications of reform in the drama. During the eighties Archer saw signs of hope in the work of Grundy, Pinero, and Jones, and called upon them to take the lead in the revitalization of English drama. Toward the close of this decade he called to the attention of his countrymen startling new tendencies on the continent and in Scandinavia, and insisted that England's dramatists must join this movement if its drama were to achieve artistic and intellectual maturity. During the decade of the nineties Archer emerged as a leader of the pro-Ibsen forces when the great Norwegian's plays were introduced to the English theatre.

Archer continued, during the nineties and after the turn of the century, to support reform in the English commercial theatre, noted and welcomed such new writers as Wilde

and Barrie, and urged other writers of literary stature to bend their efforts to the dramatic form. The critic, in addition, gave invaluable support to the drama of the independent theatres, and believed that in the "intellectual drama" of Shaw, Barker, and Galsworthy the English theatre had, at last, vindicated its great inheritance.

The following conclusions are drawn concerning the essential nature of Archer's dramatic criticism: (1) A strongly rational, judicial critic, Archer occasionally was somewhat too rigidly bound to the concept of the logical, realistic formula. More often then not, however, his criticism was characterized by remarkable flexibility and breadth. (2) Archer placed great emphasis on skillful craftsmanship, and his criticism demonstrated a slight affinity for the theatrical, even, at times, the melodramatic elements in drama. His credo, therefore, represented an integration of realism and theatrical effectiveness.

Archer's major contributions to the drama are as follows: (1) His strongly rational criticism exposed the artificiality of much of the drama of the day and encouraged the creation of a realistic drama which demonstrated a vital relationship with social and intellectual problems. (2) His earnest criticism, implementing an attitude of respect for the potentialities of English drama, helped create the intellectual milieu in which an independent and virile drama might flourish. (3) His policy of "fertilizing" criticism resulted in a direct and beneficial relationship with the leading dramatists of the renascence. (4) He played a leading role in the introduction of Ibsen to England. (5) He was the first authentic historian of the renascence of modern English drama. 403 pages. $5.20. Mic 57-225

JAMES JOYCE'S EARLY ESTHETIC: A STUDY OF ITS ORIGIN AND FUNCTION

(Publication No. 19,074)

Edward Francis Callahan Jr., Ph.D.
The University of Wisconsin, 1956

Supervisors: Professor Frederick J. Hoffman
and Professor Paul L. Wiley

Little critical attention has been given the origin and growth of the esthetic theory which James Joyce developed early in his career. Those critics who have discussed this theory have failed to distinguish between the esthetic expressed in Stephen Hero and that in A Portrait of the Artist as a Young Man. An analysis of the distinction between the two theories is helpful in understanding Joyce's artistic growth as significant esthetician as well as creative artist.

Joyce began his esthetic speculations as a reaction to the inadequate Platonic criticism he encountered in Dublin. He sought to form a theory of art in a synthesis of traditional critical norms, chiefly those of Aristotle and Aquinas. In their philosophy he found a basis for his esthetics which placed the emphasis upon the work of art itself rather than on its social or moral effect. In Aquinas he found a definition of beauty which provided him with a standard of criticism and a norm of artistic creation. His early work with Aquinas in Stephen Hero shows him ignorant of some of the finer points of philosophy but at the same time successful in transmuting metaphysics into a prescriptive definition of art.

The Aquinian definition of beauty is central to the esthetic of Stephen Hero and figures strongly in his book reviews and in Dubliners. In the latter his "applied Aquinas" is most evident where he attempts to give integritas, consonantia and claritas to each of the stories and to the book as a whole. In A Portrait, however, he relegates Aquinian theory to the philosophical realm, and develops in its place his earlier lyric-epic-dramatic theory. It is this theory which gains prominence in his subsequent work.

His theory of dramatic objectivity, though stated in Stephen Hero, is not fully developed until A Portrait, where it is closely allied to the romantic theory of the heterocosmic analogy concerning the independence of creator and created, artist and work of art. It is this theory which governs Joyce's work as a creative artist after Dubliners. He follows it by creating a character and endowing it with the freedom to create the form of the work. The character of Stephen Dedalus determines the form of A Portrait, the interaction of the characters of Stephen and Bloom gives form to Ulysses, and the complexity of HCE's mind creates the form of Finnegans Wake. In each novel the complexities and tensions within the central character create the form of the work.

Joyce's movement from the prescriptiveness of the Aristotelian-Aquinian esthetic to the more relaxed theory of creation manifests a gradual maturing in his philosophical approach to life. The early tensions are relaxed in his later work and he seems more in sympathy with the philosophy of becoming than with the ontology of scholastic philosophy. His early allegiance to the philosophy of definitions has mellowed into one which sees ultimate reality as not completely knowable. Psychologically he has changed from the Apollinian to the Faustian vision of the world.

The origin and development of Joyce's early esthetic theory is best seen in terms of this shift from a philosophy of being to one of becoming. Early in his speculations he saw the world as definable and thus sought definitions of art and beauty in the traditional philosophies of Aquinas and Aristotle. In his work after Dubliners he shows less confidence in the traditional ontology. This change in philosophical outlook affected his creative work as well; in Ulysses and Finnegans Wake the specific nature of the work of art determines its particular organic form free from the rigid prescriptiveness of artist or esthetician.

324 pages. $4.15. Mic 57-226

VICENTE BLASCO IBÁÑEZ: SOCIAL REFORMER AND PROPAGANDIST

(Publication No. 17,946)

Virginia Frances Curry, Ph.D.
Indiana University, 1956

Vicente Blasco Ibáñez, admirable novelist and short-story writer of Valencia, holds an eminent position among the cultivators of the modern novel in the history of Spanish letters. He belonged to the period of the flourishing, realistic literature of the nineteenth and twentieth centuries in which Pedro Antonio de Alarcón, Juan Valera, Jose

María de Pereda, Benito Pérez Galdós, and Palacio Valdés were his contemporaries. In the trend of the new school he and the aforementioned authors delineated pictorially the realities of nature, of character types, and environments and gave absorbing interest to the manifold expressions of the drama of life.

Apart from Blasco's superb regionalism and realism, his assumption of a social mission in literature is fundamental and significant throughout his literary career. The purpose of this study is to give detailed consideration to his varied aspects as a social reformer and propagandist. It proposes to reveal him in works of his different periods as an author of broad humanitarian sympathies, of commiserative spirit, and with an abiding interest in society's vital problems. It aims to manifest his characteristic concern in atmospheres of unprogressive living, in retarded and generally unenlightened communities.

In the initial series of Valencian novels -- Arroz y tartana (1894), Flor de mayo (1895), La barraca (1898), Entre naranjos (1900), and Cañas y barro (1902) -- one feels, over and above the incomparable descriptive features, the youthful Blasco's desire for his Valencia's progress, for the populace's relinquishment of outworn traditions and for its assumption of more advanced social perspectives. His censure with respect to conditions in these environments and to those of other Spanish communities strikes forcibly against usurious practices with the consequential abuse and impoverishment of the masses, against the lack of adequate educational facilities and the absence of education as a functional influence in the lives of the people. He attacks rural politicians, their lack of altruistic motivation, their unenlightened practices and conceptions. He is critical of problems of land ownership. Furthermore he censures the harsh and unrewarding life of women in the occupational toil of rustic environments, the evils of alcoholic indulgence, and the bourgeois society that is centered in social appearances and false outward display of luxury.

In La catedral (1903), El intruso (1904), La bodega (1905), and La horda (1905), the novelist becomes a national reformer and propagandist. Departing from his region for the climes of Bilbao, Toledo, Madrid, and other cosmopolitan centers, he broadens his vision and attains new inspiration from a more national point of view. He strongly rebels here against the poverty-ridden districts in the peripheral areas of Madrid, the exploitation of labor by propertied interests and capitalists, the excessive power and affluence of the Church. Moreover, his spirit of anticlericalism causes him to view retrospectively the religious excesses of past centuries as contributive factors of the Spanish decadence and retardation of progress yet present. He is critical of the religious policies of the "Reyes Catolicos" (Ferdinand and Isabel)-- the institution of the Inquisition during their reign, the expulsion of Jews and Moors, the abandonment of industrial and agricultural development for military engagements of the cross and the sword. He asserts that Charles V and Phillip II followed the pattern of their predecessors, and that in the reigns of Phillip III, Phillip IV, and Charles II the consequential decadence became absolute. In viewing the Spain of his day Blasco regards the spirit of decline as yet lingering, the clamps still firm upon freedom of thought and worship, the past still negatively influencing expressions of life and culture in the nation of the present. He proposes a curbing and limitation of the Church's power.

A zone of rebellion that differs conspicuously from the above is the novelist's negative attitude toward bullfighting and gambling. Varying also from much of his earlier criticism is the spirit of propaganda in his trio of war novels-- Los cuatro jinetes del Apocalipsis (1916), Mare nostrum (1918), and Los enemigos de la mujer (1919). Here he becomes a partisan of the ideology of the Allied Nations and inimical to the principles of German militarism. Becoming the "novelista del mundo" his broader view is hope for ultimate termination of the barbarities of war and for a permanent and universal peace -- the existence of one world and citizenry united by the bonds of love, peace, and sympathetic understanding.

Blasco's total work proved him to be both Spanish and universal. He was a Spaniard in his patriotic love for his country, in his oft-recurring flash of optimism for her greater regeneration. He longed for a vigorous Spain with a progressive populace, comparable in its civilization with that of any other nation. He evinced universality of character in the wide range of his literary motivation, in the breadth of his themes, and the divergence of his settings. The novelist, indeed, left for posterity an admirable, challenging literature reflective of a regional, national, and universal love for mankind.

193 pages. $2.55. Mic 57-227

SOCIAL AND CULTURAL CRITICISM IN THE WORKS OF ERNST WIECHERT

(Publication No. 19,696)

Bernard Jay Fridsma, Sr., Ph.D.
University of Michigan, 1956

The introductory chapter of this study, written for the purpose of supplying background, briefly sketches the life of Ernst Wiechert and characterizes his works. The succeeding chapters attempt a rather detailed examination of Wiechert's critical position in regard to (1) urban civilization, (2) education, (3) the Fatherland, (4) the war system, (5) Christianity and the Church, (6) National Socialism, and (7) art and science. The examination is carried out in the light of the poet's total literary production, to which constant reference is made.

The study, in analyzing Wiechert's social and cultural criticism, points out that the poet considers Western culture on the decline since the days of Goethe and Beethoven. There is in Germany and the West, he feels, an excessive preoccupation with the things of the intellect ("Geist"), which has brought on a process of secularization ("Entgötterung") and an estrangement from the spiritual and supernatural ("das Magische"). He sees the evidence of this decline in practically all forms of art. He sees it also in the rise of a materialistic science, which has done much to rob life of its mystical dimensions and thereby, in turn, has led to a lack of reverence for life and a disregard for man's dignity and individuality. He sees it even in the face of the modern Massenmensch which, he believes, registers an estrangement from God. He sees it especially in the rise of Nazism (which to him is no uniquely German movement) and in the dropping on Hiroshima of the first atomic bomb.

Wiechert's social and cultural criticism, the study

finds, is largely in terms of men. This it holds to be consonant with the poet's position that man's troubles stem fundamentally not from bad systems, methods, or techniques, but from bad hearts. The poet is not a believer in the romantic notion of the inherent goodness of man, but he realistically senses the presence in the world of radical evil ("das Urböse"), against which, in the last analysis, education and social reform are impotent. Wiechert sees as the primary requisite of a new society spiritually reborn men.

The study defends Wiechert against the charge that he is "anti-intellectual." It also rejects the theory that there are two Wiecherts: the heroic fighter against Nazism and the impractical "Eastern" mystic whose writings tend to foster a dangerous political lethargy. It seeks to indicate that there was no paradox in the poet's life, and that his valiant stand against Hitler was very much related to, in fact rooted in, his affinity with the East. It holds that not Wiechert's mysticism, but his strong-willed idealism and perfectionism lie at the root of his so-called "unpolitical" attitude.

In its ethical tenor, the study maintains, Wiechert's message is largely that of the Law and the Prophets, of Christ and His apostles. For Wiechert, too, love is the fulfillment of the law. His ethic of love, however, is nowhere in his works related to a God of love. Thus, the study concludes, the Christian ethic is completely divorced from its ageless dynamic, the Christian Gospel. There is reason to fear that the poet's work, instead of doing its bit in the fight against "Entgötterung" may, in fact, be promoting it. 255 pages. $3.30. Mic 57-228

THREAT AS THE BASIS OF BEAUTY: PRAGMATIST ELEMENTS IN THE AESTHETICS OF RICHARDS, DEWEY, AND BURKE

(Publication No. 18,608)

Hans Paul Hermann Guth, Ph.D.
University of Michigan, 1956

This study is concerned with attempts to adjust aesthetic theory to a "pragmatist" view of life--a view which emphasizes the functions, consequences, or ulterior aims of various aspects of behavior at the expense of the present satisfaction or fulfillment achieved. I am examining the role of "pragmatist" or "functionalist" thinking in the aesthetic theories of I. A. Richards, John Dewey, and Kenneth Burke. While dealing with each of these writers within the framework of his own critical system, I am concentrating on their common problems in attempting to make the pragmatic relevance of art the key to its essential nature. At the same time, I am presenting the material in such a way as to allow for the cumulative development of an alternative critical position which permits proper awareness of the over-all biological and psychological context but nevertheless makes it possible to look at artistic activity and aesthetic experience as legitimate ends in themselves.

Where the Romantic critic establishes the significance of aesthetic factors within the framework of a Neo-Platonic metaphysics, the critics here under review work within the framework provided by evolutionist biology. They establish the significance of the aesthetic within the context of the interaction between organism and environment, relying heavily on what William James calls the "teleological" view of mental life. While all three of the critics reviewed see the essential significance of the aesthetic in its bearing upon human welfare, Dewey--and to a lesser degree also Richards--interpret human welfare itself in aesthetic terms. Dewey and Burke--and to a lesser degree also Richards--apply functionalist considerations not only to art but also to scientific and speculative thought. Paradoxically, the same functionalist considerations used to elevate the one result in an underestimation of the other.

Their inconsistencies in applying functionalist considerations to art and science, their common failure to recognize the limited applicability of functionalist considerations in both cases, and the wide divergence in their different functionalist explanations indicate that these critics are using functionalist biology and psychology to defend attitudes developed independently of a scientific-positivistic approach to aesthetics. The explicit recognition of indebtedness to Romantic Neo-Platonists in the case of Richards and Dewey, and the development from Neo-Platonic and Neo-Kantian considerations in the case of Burke, show the influence of a traditional over-estimation of the aesthetic that is most clearly evident in the Romantic Neo-Platonists but that in lesser forms is widespread among literary men who consider themselves part of a "humanist" tradition. In effect, the "scientific humanists" here examined use a scientific-positivistic framework and terminology to promote or defend a non-scientific and often anti-scientific evaluation of the aesthetic element in experience.

By coordinating those elements in their theories which point to a recognition of art as an end in itself, one can develop an alternative view of art as a specifically human deviation from processes involved in the satisfaction of organic needs. Both formal beauty and emotional stimulation as the two main elements of aesthetic appeal have evolved within the margin of independence made possible by the pain-pleasure motivation. They need neither a functionalist nor a metaphysical justification.

293 pages. $3.80. Mic 57-229

ASHES OF THE PHOENIX: A STUDY OF PRIMITIVISM AND MYTH-MAKING IN D. H. LAWRENCE'S THE PLUMED SERPENT

(Publication No. 19,702)

Jascha Frederick Kessler, Ph.D.
University of Michigan, 1956

This essay is an analysis of ideas in D.H. Lawrence's The Plumed Serpent. Almost thirty years of criticism have failed to establish its nature and worth as an embodiment of ideas about man and society integral to his last decade of writing. Recent evaluation tends to exalt literary, or formal aspects of his work, relegating his radical denunciations of modern civilization to obscurity because they challenge fundamental Western values. This essay shows that Lawrence cannot be properly understood unless there is comprehension of his principles and their essential relationship to the drama in his novels.

Chapter I reviews criticism of The Plumed Serpent and books preceding and succeeding it. Next, the method

of examination is presented; this is based on Professor Karl Mannheim's suggestions for a 'sociology of knowledge,' especially his analysis of 'objective,' 'expressive,' and 'documentary' contents in any work of art.

Chapter II reveals the 'objective' content of The Plumed Serpent as a true myth conforming to the pattern of great world-myths. This level of Lawrence's narrative is sui generis, and quite disjunctive from what he considered his myth-making style and from his didactic purposes.

Chapter III considers problems Lawrence dealt with in his last ten years, showing how they entered into his writings on the level of 'expressive' and 'documentary' meaning. Section i analyzes basic tenets of primitivist thought, and proposes that the 20th Century variety of primitivism is a new phenomenon. Section ii discusses other works by Lawrence which, when compared with one another, disclose that the "cosmology" and "physics" he propounded led ineluctably to a primitivist philosophy. Remaining divisions of this chapter discuss the four aspects of The Plumed Serpent's primitivism. On the 'expressive' level, sources of his conflict with society and within himself, and its outcome in his books, are dealt with; on the 'objective' level, the intrinsic self-contradiction of his philosophical ideas is disclosed. These sections contain: (a) his conception of a tribal politics for modern nations; (b) his revolt from history; (c) his rejection of all aspects of machine technology; and (d) his mistaken idea of the nature of myth, and its consequent misuse as a literary device. These features of Lawrence's primitivism stem from the extreme nihilism of modern times, and through his dualistic and mechanistic world-theory become transformed into a most formidable anti-rationalism.

The main conclusions result from this study. The first states that, despite Lawrence's preposessions, he created a great mythical story in The Plumed Serpent, which places his artistic genius close to the first rank of novelists. The second is more complex and equivocal, for it maintains that Lawrence's nihilistic anti-rationalism, while deplorable from a detached or universal position, is yet an outstanding characteristic of modern creative thought; furthermore, that in our time nihilism represents a most advanced intellectual stand. Though his ideas have, in other hands, brought the world twice to the brink of self-destruction and chaos, he nevertheless maintained them as an honest response to contemporary social problems. From this study's historicist and rationalist view it may thus be said that Lawrence's contribution to literature is important precisely because it explores the dangerous regions towards which his fearless thought carried him, and that, though criticism must demur from what he seems to have believed a correct direction and goal, his negative value as thinker and artist is quite as high as it may have been were his ideas acceptable. "The errors of genius are the portals of discovery," wrote James Joyce; given the inversion of all values in modern times, perhaps Lawrence's inversion may ultimately be valued as truly precious. 257 pages. $3.35. Mic 57-230

A COMPARISON OF LATE RENAISSANCE AND EARLY BAROQUE AESTHETICS AS SEEN THROUGH TWO DRAMATIC INTERPRETATIONS OF THE INES DE CASTRO STORY

(Publication No. 18,630)

Gustavus Hindman Miller, Ph.D.
University of Michigan, 1956

The purpose of this study is to examine late Renaissance and early Baroque concepts of the drama in Spain, as reflected in two dramatic interpretations of the story of Inés de Castro, and to determine in what ways each reflects characteristics traditionally associated with the age in which it was produced.

In Part I, an intensive study is made of the structure, style, and characterization of the Nise lastimosa (1577) of Jerónimo Bermúdez. Structurally, Bermúdez' play is shown to be an imitation of classical tragedy, and to possess the formal characteristics thereof. Imitation of the ancients is revealed in the observance of the unities of action, time, place, mood, and tone; in the utilization of five acts with choral interludes; and in the clear, simple development of a single plot. The same imitation is revealed in the style and characterizations. Ideologically, the play is seen to reflect the sixteenth century scene--belief in the divine right of kings, concern with moral and ethical issues, preoccupation with earthly fame, Neoplatonic idealization of love and nature, and faith in the infinite goodness of God. These are shown to be a part of the general Renaissance attitude towards life and reality. This attitude was marked by the acceptance of the objective reality of the world, and is reflected in the clarity, simplicity, and logical development of Bermúdez' play.

In Part II, the same procedure is followed with the Doña Inés de Castro, Reina de Portugal (1612) of Mexía de la Cerda. The analysis of its structure, style, and characterization reveals a radically different dramatic aesthetic. The unities of time, place, mood, and tone are disregarded; and the tragic, comic, ridiculous, and sublime are blended in a well-ordered whole, reflecting the complexity of contemporary life. Unity of action is observed, but it is the unity of apparent disunity, and clarity is replaced by intentional obscurity. Stylistic elements such as syntax, conceits, contrasts, metaphors, and word portraits are discussed and shown to be a part of early Baroque aesthetics. Ideologically, the play reveals a concern with heavenly, rather than earthly glory, a modeling of the tragedy of Inés upon the passion of Christ, a realistic attitude towards love and nature, a critical attitude towards the nobility, a marked concern with space, movement, and relativity, and a predilection for deceiving with the truth. These are shown to be related to the scientific, philosophical, and religious currents of the early seventeenth century, and to the Baroque attitude towards life. Baroque man realized the deep significance of individual responsibility for one's soul, and although he did not reject temporal existence, it had meaning for him only as a function of eternal existence. He was skeptical of the world, of his own conscience, and even of "truth," and his artistic creations reflect the resultant uncertainty and anxiety in their fusion of contrasting and paradoxical elements into a unified whole.

Three conclusions can be drawn from the study: (1) Each play has reflected the contemporary dramatic aesthetic

common to its genre. (2) The social, philosophical, religious, and scientific currents reflected in each play are those of its period. (3) In order to completely evaluate the artistic creations of a given period, it is not sufficient to apply to them the aesthetic standards of another; they must be studied from within the spirit of the age in which they were created. 149 pages. $2.00 Mic 57-231

ORGANIC FORM IN THE SHORTER POEMS OF EDWIN ARLINGTON ROBINSON

(Publication No. 18,633)

Elmer Samuel Moon, Ph.D.
University of Michigan, 1956

The purpose of this study has been to bring a knowledge of Robinson's beliefs and temperament to bear upon the style of his poetry in order to show the significance that his style acquires from its organic relationship to those beliefs and feelings. In Chapter I, I have described Robinson's beliefs and their relationship to his temperament. In Chapter II, in order to clarify his poetic intentions, I have described the kind of writer he aspired to be and the kind of reader he hoped to find. In the chapters of Part II, I have shown how the stylistic order which appears in his diction, syntax, symbol, and design bears the personal stamp of his beliefs and temperament.

Robinson's beliefs center upon a pattern of the growth of the mind which is typically transcendental, and which he felt that all men and women followed in whole or in part. Its stages are: innocence, illusion, disillusion, a limited awareness of spiritual truth, and a full transcendent vision. Although such a belief is basically optimistic, the deep gloom of Robinson's temperament led him to emphasize the dark side of the spiritual pilgrimage, the struggle and pain, the difficulty of achieving vision, so that his mood is closer to Puritanism or to the mood of Sartor Resartus than to that of Emerson or Wordsworth.

Robinson found this pattern of spiritual growth in both the poet and the reader of poetry. His transcendentalism led him to value the embodiment of inspired truth rather than beauty as the end of poetry, and his temperament led him to value the poet's arduous struggle as a necessary means to that end. Correspondingly, he felt that in the fullest reading of the best poetry the reader struggles intensely with the poem and achieves thereby an insight into the transcendent truth that the poem organically embodies.

When we turn to the style of Robinson's poems, in Part II, with his beliefs and temperament in mind, we find that they exert an organic discipline almost everywhere upon the materials of diction, syntax, symbol, and design. His diction of simple, prosaic words and polysyllabic language reflects his interest in the drama of the commonplace and in the poetry of contemplation. His complex syntax carries a poetry of the mind in action and of ineffable spiritual mysteries. His simple, "natural" symbols of houses and hills, islands and ocean, sunset, seasons, and trees embody the transcendent force present in the common things about us. His most widely used design, in which a particularly revealing detail or statement illuminates from the end of a poem the meaning of what has gone before, reflects his belief in the necessity of struggle and in the insight that may finally come as a consequence. All these widely prevalent characteristics of his style, together with many other characteristics less frequently found, are unmistakably organic to his beliefs and temperament, the poetic body of his thought and feeling.

283 pages. $3.65. Mic 57-232

THE NATURE OF THE SATIRE IN "A TALE OF A TUB"

(Publication No. 19,713)

Philip Pinkus, Ph.D.
University of Michigan, 1956

The purpose of this study is to demonstrate by a close reading of the text that Swift's A Tale of a Tub is an artistic unit, every stroke of which is calculated to create one dominant effect, and to suggest something of the nature of this effect. The study is divided into two parts, first, a detailed analysis of the text, second, an examination of the satiric criterion.

In the analysis, the assumption is made that A Tale of a Tub should be considered not as prose but as poetry and should be analysed as carefully as poetry is analysed. From this basis, three means of approach are used: (1) viewing the Tale as Swift's persona, the hack author, would view it, as a world which to reasonable men might seem mad but to him is perfectly normal and respectable -- the satire thus becomes an unfolding drama with the hack author as the leading character; (2) tracing through the symbolism in the text; (3) stressing the eighteenth century associations of the language and of the social situation behind the satire.

One unifying device Swift uses is his persona, the hack author. The whole dramatic situation of the Tale of a Tub world is seen through his eyes. Viewed in this way the religious allegory of the Tale becomes also a satire on projectors of the Royal Society, on modern writers and philosophers. Correspondingly, the so-called other half of the Tale becomes not merely a satire on learning but, through the persona and the other characters of the Tale of a Tub world, a satire on religion and on almost every aspect of Swift's society. Thus, no single section is devoted exclusively either to religion or learning: throughout the text a whole world is brought to judgement. The dominant characteristics of this world we perceive partly through the unfolding character of the hack author and his fellow citizens.

Another unifying device is the three machines of human aspiration outlined in the "Introduction," the pulpit, the ladder, and the stage-itinerant. Ultimately, all the subject matter of the text comes under the category of one of these symbols. The three symbols in turn are reduced to the one symbol of the stage-itinerant, for it "is the great seminary of the two former [the pulpit and the ladder]." In a sense, A Tale of a Tub is a great itinerant stage on which the mad mountebanks of a vagrant humanity are acting their parts. It is a world of unreason -- and unreason is the common denominator, the final unifying force of A Tale of a Tub.

One must then determine the nature of reason, the satiric criterion of A Tale of a Tub. The conclusions reached are that Swift's reason is not typical of the

Enlightenment or of the last half of the seventeenth century. It is closer to Hooker and Renaissance humanism than to Tillotson and Latitudinarianism. In fact, the basic element of Swift's reason is a humanism percolated through the orthodox structure and ritual of the Church of England. Swift's satire is essentially religious.

Ultimately A Tale of a Tub has all the elements of tragedy but its dignity. Or as Swift puts it, life is not a farce but "a ridiculous tragedy, which is the worst kind of composition." 332 pages. $4.25. Mic 57-233

THE RECEPTION OF FRANZ GRILLPARZER'S WORKS IN ENGLAND DURING THE NINETEENTH CENTURY

(Publication No. 19,716)

Ernest Reinhold, Ph.D.
University of Michigan, 1956

It is the purpose of this study to show the varied reception given to Grillparzer's works in England during the nineteenth century. Whereas monographs about Lessing, Goethe, Schiller, Kotzebue, Tieck and others in their relationship to British interest in German literature have been available for some time, no thorough investigation has been undertaken with respect to Grillparzer. It is intended to fill this gap in Anglo-German literary relations by making a critical analysis of articles and reviews in British periodicals, translations, scholarly publications, and stage productions.

In 1819 interest in the fate tragedy drew the attention of British writers to Grillparzer's Ahnfrau and subsequently to his other early works, particularly Sappho. During the third decade these plays were frequently reviewed and partially translated in the journals. A mediocre full-length translation of Sappho was also published and reprinted at that time. Carlyle's scathing review-article "German Playwrights" (1829), which presented a picture of Grillparzer as a second-rate dramatist, contributed materially to his neglect during the following quarter century. Increased, German recognition of Grillparzer shortly before his death, in 1872, and the publication of his works soon thereafter is reflected in England in a second brief period of interest in the poet.

Closely related to Grillparzer's neglect in England is the popularity of Goethe and Schiller in that country during the nineteenth century. Compared to the greatest German poets, the Austrian dramatist was found wanting and was denied, except by few critics, his independent status. Although he was actually regarded as a better dramatist than Werner, Müllner, Houwald, Raupach, and others, such recognition counted for little since these authors were either not well known or were notorious for their productions. This biased evaluation can be traced, in part, to its German source. The negative attitudes of Tieck and Gervinus were known in England, and British scholarly opinion, as expressed in early histories of German literature, tended to uphold the German view of Grillparzer as a distinctly minor literary figure. By contrast, his early successes on the Austrian and German stage elicited little interest from British reviewers. His poetic dramas, especially Sappho, were received more as closet drama than as eminently stageworthy productions. During a century in which the melodrama and plays with musical accompaniment flourished, the few Grillparzer dramas which were given an occasional performance--Die Ahnfrau, Medea, Des Meeres und der Liebe Wellen-- had to be adapted to the demands of public taste. Consequently, little of the original remained. In addition, the concern of British critics with questions of morality and "good taste," and their search for moral precepts in literary works seriously hampered their appreciation of Grillparzer who was indifferent to these requirements. They failed to recognize, therefore, the salient features of Grillparzer's works: the dichotomy in the world of his characters and the quietism and resignation expressed in several of his plays.

Only three full-length translations of Grillparzer's works were published before the end of the last century, but only two do justice to the poet. His lyrics are scarcely represented in translation and his Novellen were barely mentioned. The present century, however, has ended this indifference towards Grillparzer. It has corrected earlier misunderstandings and revised the scholarly opinions of his works. Though not a popular success as in German speaking countries, Franz Grillparzer is being recognized in England as the greatest dramatist after Schiller.

203 pages. $2.65. Mic 57-234

GEORGES FEYDEAU ET SON OEUVRE

(Publication No. 19,730)

Edwin Daniel Yahiel, Ph.D.
University of Michigan, 1956

Georges Feydeau (1862-1921) was, in his day, the most celebrated French comic playwright. For a few years after his death his work was somewhat neglected. In 1938 a powerful revival of Feydeau began and today a re-evaluation of his theater by French critics places him among the major dramatists of France.

There have been no critical studies on Feydeau. The biographical materials are scattered and sketchy. The existing references are unclassified and difficult to find. For the first time a complete edition of Feydeau's theater is now being published in Paris by the Editions du Bélier.

This study endeavors to organize the extant materials on the man and his work, and includes a biography as well as a historical and critical analysis of his plays. Since Feydeau is in the current of the farce, while at the same time deviating from it in order to create a very personal and characteristic genre, we trace the development of the French farce up to and since Feydeau. For purposes of comparison an entire section is devoted to Labiche, Feydeau's closest predecessor.

The critical analysis of Feydeau's methods which constitutes the largest section of this study stresses the impossibility of isolating the so-called technical devices from the whole, which is the play itself. Feydeau's most unusual achievement is the construction of a tremendously complicated comedy of situations and characters which gives the impression of the spontaneity of the commedia dell'arte. Those aspects are treated separately and concurrently. The application of the various theories of laughter, e.g., Bergson's, is discussed with respect to

Feydeau and the farce in general. Other analyses include that of Feydeau's appeal to both naturalists and surrealists, his creation of original characters, his relationship with the society of "la belle époque", Feydeau's theories of stagecraft, the author as his own stage director, the techniques of attaining an unemotional relationship between audience and actors and his successful attempts at creating pure comedy devoid of theses.

We trace the development of laughter on the French stage since Feydeau and its relationship with the cinema and today's theater, especially the predominant mixed genre.

The last chapter deals with Feydeau's revival, its possible causes and effects, Feydeau's position in the contemporary theater and an appraisal of comedy trends during the 1940's and the 1950's.

Correct chronologies of performances have been derived from several incomplete and often contradictory sources.

The bibliography contains rectifications of current and past references to Feydeau, and for the most part material heretofore unlisted. It includes a guide to criticisms of individual plays.

381 pages. $4.90. Mic 57-235

INEQUALITIES FOR COEFFICIENTS OF SCHLICHT FUNCTIONS

(Publication No. 19,916)

Joseph Omer Carter, Ph.D.
Stanford University, 1956

In the subject of conformal mapping, a great amount of interest has centered about the famous Bieberbach conjecture. The Bieberbach conjecture states that if

$$f(z) = z + a_2z^2 + a_3z^3 + \ldots + a_nz^n + \ldots$$

is a function which is schlicht in the interior of the unit circle $|z| < 1$, then $|a_n| \leq n$. The conjecture has been proved for $|a_2|$, $|a_3|$, and $|a_4|$. The primary purpose of this research was to obtain an improved numerical upper bound for the fifth coefficient. However, the methods used enable us to obtain upper bounds for the next several coefficients.

We use the Prawitz function

$$F(z) = \left[\frac{f(z)}{z}\right]^{-r/2} = 1 + \sum_{n=1}^{\infty} b_nz^n$$

to derive the relation

$$b_n = -\frac{r}{2}a_{n+1} + \sum_{j=1}^{n=1}\frac{j(2-r)-2n}{2n}a_{j+1}b_{n-j},$$

which is valid for every real value of r. Restricting our choice of r to the range $0 < r < 2$, we derive the inequality

$$|a_{n+1}| \leq \frac{1}{n}\left[\frac{1}{r}\sum_{j=1}^{n}[r(n-j) + 2j]^2\left|\frac{a_{n+1-j}}{2j-r}\right|^2\right]^{1/2}.$$

From the above inequality, with the proper choices of n and r, we are able to derive the following numerical upper bounds

$$|a_5| < 5.38, |a_6| < 6.79, |a_7| < 8.30, |a_8| < 9.92, |a_9| < 11.65,$$
$$|a_{10}| < 13.50, |a_{11}| < 15.44, \text{ and } |a_{12}| < 17.51.$$

We also prove that for an extremal function which makes $|a_5|$ a maximum $|a_4| > 3.51$, $|a_3| > 2.53$, and $|a_2| > 1.69$.

29 pages. $1.50. Mic 57-236

TOPOLOGY OF MAPPINGS IN LOCALLY CONVEX TOPOLOGICAL VECTOR SPACES, THEIR DIFFERENTIATION AND INTEGRATION, AND APPLICATION TO GRADIENT MAPPINGS

(Publication No. 18,604)

Jesús Gil de Lamadrid, Ph.D.
University of Michigan, 1956

The original motivation of this study was an attempt to extend to locally convex topological spaces (l.c.t.v.s.) the work done by E. H. Rothe on functions and their gradient mappings. To do this, a theory of differentiation and integration of mappings was needed, which itself demanded a knowledge of the topology of mappings.

Under the heading, topology of mappings, two main topics are included. The first has to do with relating properties of an individual mapping to the topologies of its domain and range. The main notions in this connection are compactness and the various notions of continuity. If E and F are two l.c.t.v.s.'s and $K \subset E$, a mapping of K into F is compact if it maps every bounded subset of K into a compact subset of F. The main tool used in this part is that of replacing the original topology of either K or F by a suitable topology, with respect to which a given mapping has a desired property.

The second topic deals with the space $\mathcal{L}(K, F)$ of all mappings of K into F and the space $\mathcal{L}(E, F)$ of continuous linear mappings of E into F. We establish that certain given subspaces of $\mathcal{L}(K, F)$ are closed under various important topologies. Moreover, we establish a duality between E and $\mathcal{L}(E, F)$, which reduces to the well-known duality between E and its dual (conjugate) space E′, in case F is the field of real numbers.

In applying this work to differentiation, we replace the increment $f(k + x) - f(k)$ and the differential $df(k, x)$ by elements of $\mathcal{L}(E, F)$, and take limits with respect to various topologies of $\mathcal{L}(E, F)$. The main notion in this connection is that of the derivative f′, a mapping of K into $\mathcal{L}(E, F)$. If F is the field of real numbers and f is properly restricted, f′ maps K into E′, and f′ is called the gradient mapping of f.

The main results of this study are as follows: (1) Continuity relative to bounded sets reduces to ordinary continuity if we replace the original topology of K by a suitable one; (2) The uniform limit of compact mappings is compact; (3) Two of the basic differentials in the classical theory can be obtained as special examples of a general differentiation process; and (4) Mappings with compact derivatives are continuous in a suitable weak topology.

143 pages. $1.90. Mic 57-237

ON VERTICES OF SPACE CURVES WITH RESPECT TO FAMILIES OF SURFACES

(Publication No. 17,802)

Donald Greenspan, Ph.D.
University of Maryland, 1956

Supervisor: Professor Stanley B. Jackson

A new approach, which avoids differentiability assumptions and which has a potential topological generalization, is made in the study of vertices of n-dimensional space curves, $n \geq 3$. Basic definitions, ideas, and lemmas concerning hyperplanes and hyperspheres, necessary for the study, are developed first. Classes of arcs and curves

called base arcs and base curves, respectively, are then defined. Immediate observations on such arcs and curves are noted in remarks and lemmas. A fundamental theorem, the Reduction Theorem, used repeatedly in later work, is then proved. This theorem enables one to always employ the more useful "point of intersection" rather than the "point of support" in any discussion of the point set intersection of an arc (or curve) and a hypersphere (which term includes the concept of hyperplane).

Subsequent to further definitions, remarks, and lemmas, the following major results are proved: (a) Contraction Theorem. Let hypersphere K be oriented and meet base arc B (or base curve C) in (n+2) distinct points. Then it is possible to generate a descending sequence of (n+2)-tuples whose spans converge to zero. (b) If

$$P_1, P_2, \ldots, P_{n+2}$$

are points of B·K in natural order, then the closed subarc T of B with initial point P_1 and terminal point P_{n+2} contains, in its interior, at least one K vertex. (c) A subarc T of B possesses KOV (n+1) if and only if in the interior of T there exists no K vertex. (d) A base arc B contains in its interior finitely many K vertices if and only if B may be written as the union of finitely many closed subarcs whose interiors are pairwise non-intersecting, and each of which possesses KOV (n+1) and whose boundary points are exactly the K vertices interior to B. (e) Two Vertex Theorem. Every base curve C which meets hypersphere K in at least (n+2) points has at least two vertices.

Finally, an example of a base arc and a discussion of extant problems is presented.

65 pages. $1.50. Mic 57-238

ON A CLASS OF SINGULAR PERTURBATIONS

(Publication No. 19,531)

Anthony Kooharian, Ph.D.
Brown University, 1956

This study is devoted to the class of singular perturbation problems for differential systems characterized by a small parameter as the coefficient of the leading order derivatives in the differential equation. A general method of analysis together with a successive approximation scheme is developed based on the concept of boundary layer theory. The first part of the study contains the rigorous analysis of a nonlinear ordinary differential system. Essentially the same method of analysis is used in the second part for a nonlinear partial differential system (the Navier-Stokes equations).

The general relationship between the approximation system developed in this study and the usual boundary layer approximation, as well as the "optimal" boundary layer approximation of Kaplun is established.

62 pages. $1.50. Mic 57-239

A PROBLEM OF ROSSER AND TURQUETTE IN MANY-VALUED LOGIC

(Publication No. 20,020)

Angelo Margaris, Ph.D.
Cornell University, 1956

An affirmative solution is presented to the following problem, posed by Rosser and Turquette in their book Many-valued Logics. For every triple $<s,t,m>$, where s, t, m are truth values such that $1 \leq s < t < m$, does there exist a system of m-valued logic satisfying the following conditions? 1) Every statement which always takes values $\leq s$ is provable; 2) no statement which ever takes a value $> t$ is provable; 3) of those statements which always take values $\leq t$ and sometimes take a value $> s$, some are provable, and some are not. A system W of statement calculus is presented which solves the problem for the case s=1, t=2, m=3, and it is shown how to modify this system to solve the general case. W is then extended to a system W_0 of the restricted predicate calculus, which solves the problem for the case s=1, t=2, m=3 on this level. Again W_0 may be modified to solve the general case.

51 pages. $1.50. Mic 57-240

A METHOD FOR FINDING THE CHARACTERISTIC ROOTS AND VECTORS OF AN ARBITRARY REAL SYMMETRIC MATRIX

(Publication No. 19,640)

Marshall Middleton, Jr., Ph.D.
University of Pittsburgh, 1956

An iteration method is developed for determining all the characteristic roots and vectors of an arbitrary real symmetric matrix. In this method, emphasis is placed on obtaining first the characteristic vector, then its corresponding root. By adopting this philosophy, the problem created by the many-to-one correspondence between the vectors and roots of a matrix ceases to exist. Once a root and vector of the original matrix have been obtained, the order of the matrix is reduced by means of a transformation involving the derived root and vector. Hence, the amount of computation required to obtain the next characteristic root and vector is considerably reduced. The characteristic roots and vectors of the original matrix are derived from the aggregate of roots and vectors of the reduced matrices.

The algorithm, $X_{i+1} = X_i + \alpha_i AX_i$, $(i = 0, 1, 2, \ldots)$, is used to obtain the characteristic vectors. The vectors X_{i+1} and X_i are the $(i+1)^{-th}$ and i^{-th} approximations to the characteristic vector, respectively. A is the matrix for which the roots and vectors are to be obtained. The scalar, α_i, is the root of a third order polynomial which theoretically minimizes the difference between X_i and the characteristic vector.

The procedure for finding the characteristic vector of a matrix A begins with an arbitrarily chosen vector X_0. A second vector, AX_0, is obtained from X_0 by means of the linear transformation A. These vectors are used to calculate the scalar α_0. The next approximation, X_1, to the characteristic vector is established by the algorithm

$X_1 = X_0 + \alpha_0 AX_0$. By repeating the above procedure, a sequence of vectors X_i is obtained. When $X_{i+1} = X_i$, X_i will be the characteristic vector of A. The characteristic root corresponding to the derived vector is obtained from the simple equation, $\lambda_i = (X'_i AX_i)/(X'_i X_i)$. $(X'_i AX_i)$ is the inner product of X_i and AX_i and $(X'_i X_i)$ is the inner product of X_i with itself.

While the method converged to a characteristic vector in all cases examined, a rigorous mathematical proof of the convergence was not established. The order of convergence of the method to the characteristic vector also remains undetermined. 47 pages. $1.50. Mic 57-241

THEORY OF LEBESGUE AREA OF CONTINUOUS MAPS OF 2-MANIFOLDS INTO n-SPACE

(Publication No. 19,542)

Paul Slepian, Ph.D.
Brown University, 1956

The principal result obtained in this paper is the inequality

$$L_2(f) \leq \sum_{1 \leq i < j \leq n} L_2(P_n^{(i,j)} \circ f) ,$$

when f is a continuous function on a finitely triangulable subset of a 2 dimensional manifold into n-space, E_n, L_2 is the 2 dimensional Lebesgue area, and $P_n^{(i,j)}$ is the projection of E_n onto E_2 defined by the formula,

$$P_n^{(i,j)}(x) = (x_i, x_j) \in E_2, \quad \text{for } x = (x_1, \ldots x_n) .$$

Federer has established this result ([F1,7.14]) in the special case where dmn f is a subset of the plane. This inequality is of fundamental importance for the extension of the whole theory of Lebesgue area to continuous maps of 2 dimensional manifolds into n-space.

After a brief first chapter listing some fundamental definitions and preliminaries, our work is divided into three main parts.

In Chapter Two, the validity of the inequality is established when f is light and dmn f is a compact 2 dimensional manifold. This is accomplished by triangulating the manifold in such a way that the length of the f image of each 1 cell of the triangulation is finite, and then applying our additivity theorem due to Federer ([F2]).

In Chapter Three the connection is established between a 2 dimensional manifold with boundary and the compact 2 dimensional manifold which results when the manifold with boundary is doubled in a natural way about its boundary. In particular, if (X,A) is a 2 dimensional manifold with boundary such that X is finitely triangulable, f is a continuous function on X into E_n, Y is the compact 2 dimensional manifold obtained by doubling X about A, and F is the function on Y to E_n obtained by doubling f, we show that $2L_2(f) = L_2(F)$.

Our original problem may be simplified to the case when the domain of the function is the first element of a 2 dimensional manifold with boundary. Thus, we may further simplify the problem by assuming that the domain of the function is a compact 2 dimensional manifold.

With this assumption, in Chapter Four, we factor f into a monotone-light factorization, $f = \ell_f \circ m_f$, and use the results of Steenrod and Roberts ([SR]) to observe that if suitable small neighborhoods are deleted from the middle space, M_f, each proper cyclic element of each component of the remainder of M_f is homeomorphic to a subset of a compact 2 dimensional manifold. Furthermore, by approximating m_f by a quasi-simplicial map, we show that the Lebesgue area of $\ell_f \circ m_f$ does not differ appreciably from the Lebesgue area of ℓ_f. By using the results of Chapters Two and Three, we then prove the fundamental inequality.

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63 pages. $1.50. Mic 57-242

THE THERMODYNAMIC POTENTIAL FUNCTIONS FOR ANISOTROPIC MATERIALS

(Publication No. 19,544)

Gerald Francis Smith, Ph.D.
Brown University, 1956

Let a homogeneous body of perfectly elastic material be subjected to a deformation defined by

$$x_i = x_i(X_j) , \tag{1}$$

where x_i and X_i denote the positions of a point of the body in the deformed and undeformed states respectively, in a rectangular Cartesian coordinate system x_i.

The strain-energy function W is then expressible as a polynomial in the quantities g_{ij} defined by

$$g_{ij} = \frac{\partial x_k}{\partial X_i} \frac{\partial x_k}{\partial X_j} . \tag{2}$$

The electromechanical potential function P is seen to be expressible as a polynomial in the quantities g_{ij} and E_i where

$$E_i = E_k^* \frac{\partial x_k}{\partial X_i} . \tag{3}$$

The quantities E_i^* denote the components of the electric field vector in the rectangular Cartesian coordinate system x_i.

Then, given a particular crystal class, the problem is to find a polynomial basis for the set of polynomials in the quantities g_{ij} (for the strain-energy function W) or for the set of polynomial in the quantities g_{ij} and E_i (for the electromechanical potential function) which are form-invariant under the group of transformations characterizing the particular crystal class.

A number of theorems are given which enable these problems to be solved for each of the crystal classes and the forms which the strain-energy function and electromechanical potential take for each of the crystal classes is thus obtained. 346 pages. $4.45. Mic 57-243

GEOLOGY AND MINERAL DEPOSITS OF THE SHERIDAN-ALDER AREA, MADISON COUNTY, MONTANA

(Publication No. 19,707)

Donald William Levandowski, Ph.D.
University of Michigan, 1956

The Sheridan-Alder area, on the southwestern flank of the Tobacco Root Mountains in southwestern Montana, is underlain chiefly by pre-Cambrian rocks. It is bordered on the east by the Ruby River valley which is filled with Tertiary basin beds and alluvium.

The pre-Cambrian rocks include metamorphic rocks and granitic, ultramafic and diabasic intrusives. The metamorphic rocks that are correlated with the Cherry Creek group, which is widespread in southwestern Montana, consist of marble, epidote gneiss, graphite schist, quartzite, magnetite-hypersthene gneiss, mica schist, garnet schist, sillimanite schist, quartz-feldspar gneiss, hornblende gneiss, other amphibole gneisses, and amphibolite. Most of these rocks represent the medium to high grade regional metamorphic equivalents of mostly shales with intercalated sandstones, feldspathic sandstones, and limestones, a foreland facies of sediments. The metamorphism and its attendant folding and uplift are called the Cherry Creek orogeny. Some of the hornblende gneisses and amphibolites have been derived through the metamorphism of dolomite or chloritic shales; others have been formed as the result of the metamorphism of basalts, diabases, gabbros or diorites. Magnetite-hypersthene gneiss is the product of regional metamorphism of probably a chamositic mudstone. Sillimanite schist was formed under a combination of high intensity regional metamorphism of an argillaceous sediment and metasomatism related to the Dillon granite.

The injection of the Dillon granite and its related pegmatites and aplites took place at the end of the Cherry Creek orogeny. Injection under stress converted much of the granite to gneiss but because the aplites and pegmatites were post-kinematic they show little or no metamorphic features. Some Cherry Creek biotite schists and hornblende gneisses were intruded lit-par-lit by Dillon material to form migmatite. At a probably much later time peridotitic dikes and sills were intruded into Cherry Creek rocks. During a third and still younger intrusive period diabase dikes were emplaced along tension fractures and faults.

Anticlinal uplift, which is considered to initiate the Laramide orogeny in the area, probably began in late Cretaceous time and was followed by intrusion of a variety of intermediate to acid igneous rocks including mafic diorite, quartz diorite, quartz monzonite, diorite porphyry, granodiorite porphyry and pegmatites. Many of the hydrothermal ore deposits very likely are related genetically to these intrusives. The axis of the belt of Laramide intrusives parallels the trend of the pre-Cambrian diabase dikes.

The Laramide orogeny was followed by an interval of relative crustal stability during which the ancestral Tobacco Root Mountains were eroded to a surface of low relief as fluviatile and lacustrine deposits accumulated in an intermontane basin that in the main coincided with the present Ruby River basin. During Tertiary time the area was probably largely covered by volcanic ash and rhyolitic and basaltic flows which were almost entirely stripped away during Late Tertiary uplift and block faulting. Further modification to the present topography resulted from minor mountain glaciation just east of the area and Quaternary stream erosion.

Some of the valleys have been placered for gold with the richest and most famous deposits occurring along Alder Gulch, the southern boundary of the area. The mineral deposits include those of chromite, talc, manganese, sillimanite and garnet (pre-Cambrian) and hydrothermal veins and replacement lodes of gold, silver, copper, uranium and lead (Laramide). Pre-Cambrian and Laramide pegmatites contain quartz, feldspar, mica, amphiboles, pyroxene, allanite, epidote, tourmaline and magnetite.

Although the area has had an estimated production of gold and silver worth $1,600,000 for the period of 1900 to 1953, there is very little likelihood for any production of major importance in the future.

341 pages. $4.40. Mic 57-244

PIEZOBIREFRINGENCE IN DIAMOND

(Publication No. 19,714)

Edward Haviland Poindexter, Ph.D.
University of Michigan, 1956

In this study the stress-birefringence behavior of diamond was intensively investigated. The phenomenon has been neglected by both classical and modern crystallographers. It is only very recently that the importance of stress-birefringence effect has been realized. The effect has important applications in the study of grain boundaries, growth strains, and dislocations, all of which are presently of great scientific and practical interest. The diamond-silicon-germanium group is of great industrial importance.

The term "piezobirefringence" was proposed as being more specifically descriptive of the effect than the older term "photoelasticity."

During the theoretical portions of the study, the stress-optical constants application to cubic crystals were derived. It was found that Pockels treatment was in error for classes 23 and m3. This result confirms Bhagavantam's group-theory study.

A substantially improved method of measurement was devised. Instead of measurement of the retardation with an optical compensator, the measurement was made of intensity of transmitted light. This modification permitted the use of an electronic photometer as an observing device. The advantage arising from this method is that the photocell may be located to receive light from all portions

of the crystal; an automatic integrated average of intensity is thus obtained. The effects of non-uniform stress distribution are thus minimized.

An investigation of the causes and effects upon measurement of non-uniform loading was undertaken. A new type of crystal mounting pad was developed, which produces uniform loading from very low stresses to stresses of the order of 40,000 psi.

It was found that the diamond is almost isotropic in its piezobirefringent behavior. This conflicts with the work of Ramachandran, but confirms predictions made by Slawson and Denning for diamond, and by Bond for silicon. It is also more compatible with the elastic behavior and internal structure of diamond.

The dispersion of the piezobirefringence effect was measured for the first time. The constant q_{1212} was found to vary less than $\pm 1\%$ over the range 4400 A^0 to 7700 A^0.

The retardation was found to vary linearly with stress to the highest pressures employed, 40,000 psi. This stress is thirty times that employed by other investigators for any crystalline substance. The high stress and the linearity serve also as a confirmation of the accuracy of measurement at lower stresses.

No permanent deformation of diamond could be induced by prolonged applications of the highest stresses used. No hysteresis was observable upon rapid application or removal of load.

The diamond was found to behave as a negative uniaxial crystal when subjected to a linear compression. The lower index of refraction corresponds to light polarized parallel to the axis of compression. This result confirms the work of Ramachandran for diamond and Bond for silicon.

The isotropy of the piezobirefringence effect in diamond is unique among crystals studied, but this has been predicted for diamond and silicon. In general, the piezobirefringent phenomena in diamond are those which are to be expected on the basis of the great structural strength and hardness, the elastic behavior, and the internal structure of the crystal. 84 pages. $1.50. Mic 57-245

MUSIC

JOHANN MATTHESON'S FORTY-EIGHT THOROUGH-BASS TEST-PIECES: TRANSLATION AND COMMENTARY. VOLUME I: COMMENTARY. VOLUME II: THE TEST-PIECES.

(Publication No. 19,715)

Harvey Phillips Reddick, Ph.D.
University of Michigan, 1956

Johann Mattheson (1681-1764) was one of Germany's most prolific authors of books and articles on musical subjects; moreover, he was a talented composer. For the student of late baroque performance practices, these two facts place Mattheson in an important position. One of the phases of performance to which he devoted much attention was the matter of the elegant style of thorough-bass accompaniment, and his most comprehensive treatment of this subject is the forty-eight Test-Pieces and their Explanations. The present study has as its primary object the presentation of this corpus of musical material in modern notation and the English translation of the Explanations. The work upon which this study is based is the Grosse General-Bass Schule of 1731. The Test-Pieces are unique among the various types of music offered by the late baroque period; they consist of elaborately devised bass (or left-hand) parts for the keyboard to which have been added a carefully chosen set of figured bass symbols. These symbols, however, are merely suggestions of the type of harmonic sonority desired, but they tell next to nothing about the keyboard style to be employed in performance. The proper performance of the Test-Pieces is described in the Explanation which follows each piece, and when the composition is worked out at the keyboard in accordance with the directions, the result is a keyboard composition which closely approaches the style of written-out keyboard compositions of the time. In order to keep intact the sequence of each Test-Piece and its Explanation, as Mattheson wished, the two sets of twenty-four Test-Pieces and their Explanations have been transcribed and translated in their entirety, and in this form they constitute Volume II of the present study.

The purpose of the Commentary (Volume I) is to locate this work both within the scope of Mattheson's own works as well as to describe the book as an example of the theoretical-practical teaching of the late baroque period. In order to accomplish both aims, certain areas are investigated: (1) the several aspects of thorough-bass performance, (2) all of Mattheson's thorough-bass writings, (3) Mattheson's musical theories in general, and (4) the Test-Pieces themselves, especially in accordance with the specific thorough-bass conventions found therein.

Inasmuch as the matter of procedure in continuo playing is of concern to the modern student, a study of Mattheson's Test-Pieces and Explanations fills a need which has been present in the overall history of thorough-bass practice.

As a secondary purpose, the translation presents a better means for evaluating Mattheson as an individual than has hitherto been provided. His importance as a musical commentator and spokesman indicates that a careful appraisal of his views is warranted; yet, since most of his writings are largely based on opinion and ad hoc reasoning, it remains necessary for the modern student to be given an insight into the many more subtle aspects of Mattheson's views, much of which can be learned best by reading a translation of an extensive nature.

330 pages. $4.25. Mic 57-246

AN INVESTIGATION OF DISSONANCE PERCEPTION OF UNDERGRADUATE MUSIC MAJORS

(Publication No. 19,476)

Orville Bennett Shetney, Ph.D.
Indiana University, 1956

The purpose of this study was to discover the extent to which undergraduate music majors were able to perceive differences between relatively similar dissonant sonorities. As a tool for the collection of data, the writer constructed a "Dissonance Perception Test," and gave the test to 188 undergraduate music majors enrolled in music theory courses at Indiana University in the spring of 1956.

Played on the piano and recorded on tape, the test consisted of 90 chords arranged into 45 chord-pairs, or items. These items, having an equal number of tones per chord and a specified degree of dissonance, included three through seven tones per chord within each item. The testee indicated whether the structure or shape of the second chord was the same as or different from the first.

The test items were selected, on the basis of item analyses, from items previously tested in three pilot tests and a validation test; a test-retest of the items on the final test resulted in a reliability coefficient of 0.74.

An analysis of variables in test scores indicated (1) that open position chords are significantly easier to perceive than are close position chords, (2) that there is a significant difference in difficulty of perception between chords having three, four, five, six, and seven tones, (3) that the amount of dissonance as shown by a "dissonance factor (DF) number" is significantly related to the number of errors, but (4) that there is no significant relationship between error scores and chords having one tritone and those having more than one tritone, and (5) that there is no significant difference in error scores between chords having tritones and those not having tritones.

An analysis of test scores for the experimental sample studied indicates no significant differences in test scores according to (6) sex, (7) class standing, (8) number of semesters of theory completed, (9) or major performing medium, but (10) a significant difference was shown in test scores for candidates for the B.M. degree as opposed to candidates for the B.M.E. degree.

132 pages. $1.75. Mic 57-247

ARCANGELO CORELLI

(Publication No. 19,718)

Frank Stuart Stillings, Ph.D.
University of Michigan, 1956

The impact of Arcangelo Corelli (1653-1713) on instrumental music, as a composer, performer, and teacher, was recognized before his death, and becomes increasingly evident as more and more music of the late seventeenth and early eighteenth centuries can be studied in scores. Surprisingly little has been written about a man of such undeniable stature. For a long time the published material relative to Corelli consisted of a few excerpts from contemporary diaries, information supplied by eighteenth-century historians, and a few articles or passing references. The notes of his contemporaries were either cenni biografici containing only the barest information, or equally uninformative more lengthy reports tainted by the flowery phrases of adulation. The more recent articles mostly perpetuated the biographical anecdotes of Mainwaring, Cibber, Burney, and Hawkins, and treated the music in a rather subjective manner. Recently two noteworthy extended studies appeared on the Italian master: Marc Pincherle's Corelli, published among Les Maîtres de la Musique (Paris: Librairie Félix Alcan, 1933), and Mario Rinaldi's Arcangelo Corelli (Milan: Edizioni Curci, 1953).

Both Pincherle and Rinaldi have successfully outlined the larger concept of Corelli's importance in the field of music, but neither has included a detailed study of the musical style to show Corelli's specific contributions to the development of musical composition. An extensive analytical study has long been due.

The purpose of this thesis is to present such an analytical study of Corelli's works.

The opening chapter, "Biography," presents the available factual information on Corelli's early studies, his youthful years in Bologna, and his mature years in Rome. The chapter concludes with a discussion of Corelli's personal character. The second chapter, "Corelli's Works," is an essay dealing with the contemporary editions of his works. Included are lists of the editions known to have been printed during his lifetime. The full title of each opera is given together with the original and a translation of the dedication of each set of works.

The main body of the text is a theoretical study of Corelli's harmony with an emphasis on tonality (keys and modulations), chord structure, cadential practices, and structural application. This study is based largely on theoretical books of Corelli's time, primarily L'Armonico Pratico al Cembalo (1708) of Francesco Gasparini. The third chapter, "Keys and Key Signatures," shows the tonal scope of Corelli's works and the relationship of keys within collections, within sonatas, and within single movements. The fourth chapter, "Change of Tonality," reveals the procedures which Corelli employed in moving from one tonality to another. Chapter five, "Vertical Sonorities," presents the chords used by Corelli and shows his manipulation of these chords in forming a section of a work. Specifically treated are the various contemporary techniques of harmonizing conjunct, disjunct, and stationary bass lines, and Corelli's variations of these accepted patterns. The chapter ends with a discussion of harmonic rhythm. The sixth chapter, "Cadences," deals with Corelli's cadential practices expressed in the terminology of the time. The seventh chapter, "Form," discusses the structural features of the works.

The final chapter, "Influence," shows Corelli's extensive effect, both as teacher and composer, on the music of his contemporaries as well as on succeeding generations.

358 pages. $4.60. Mic 57-248

SYNTHESIS OF 4,4′-DIHYDROXYDIPHENIC ACID DERIVATIVES

(Publication No. 18,900)

Dale Warren Blackburn, Ph.D.
Purdue University, 1954

Major Professor: Glenn L. Jenkins

Demers and Jenkins (1) prepared several diphenic and diphenamic acid derivatives for antihistaminic or possible antispasmodic activity. The antihistaminic activity was not sufficiently intense to warrant further pharmacological testing. However, β-dimethylaminoethyl 2-carbethoxy-2′-biphenylcarboxylate was found to have a spasmolytic activity approximately equal to atropine (2). The synthesis of β-diethylaminoethyl ethyl esters of 4, 4′-dihydroxy- and 4, 4′-dimethoxydiphenic acids was attempted to examine the effect of the hydroxy and methoxy groups on the antispasmodic activity. These derivatives may also have analgesic, local anesthetic or antihistaminic activity.

Diphenic acid was nitrated with fuming nitric acid to give a mixture of 4, 4′- and 4, 6′-dinitrodiphenic acids. The dinitrodiphenic acids were directly reduced to the corresponding amino acid dihydrochlorides with tin and concentrated hydrochloric acid. The 4, 6′-diaminodiphenic acid dihydrochloride was insoluble in an excess of water and was separated from the 4, 4′-isomer. The 4, 4′-diaminodiphenic acid dihydrochloride was tetrazotized in a dilute hydrochloric acid solution by the dropwise addition of sodium nitrite. The insoluble 2, 2′-dicarboxy-4, 4′-biphenyltetrazonium chloride was hydrolyzed in a hot dilute hydrochloric acid solution, and the phenolic acid was recrystallized from water using Norite to remove the yellow azo impurities. The dimethyl ether of 4, 4′-dihydroxydiphenic acid was prepared by the reaction of the phenolic acid with dimethyl sulfate.

The anhydride of the acetoxy acid was prepared in low yields by two procedures employing acetyl chloride and acetic anhydride. The anhydride of the methoxy acid was prepared in good yields with acetic anhydride. The anhydrides were refluxed with absolute ethanol to give the half esters, 4, 4′-diacetoxy-2-carbethoxy-2′-biphenylcarboxylic acid and 2-carbethoxy-4, 4′-dimethoxy-2′-biphenylcarboxylic acid. The corresponding acid chlorides were obtained by refluxing the half esters with thionyl chloride in benzene. The acid chlorides were directly esterified with β-diethylaminoethanol. The attempted hydrolysis of the acetyl groups of β-diethylaminoethyl 4, 4′-diacetoxy-2-carbethoxy-2′-biphenylcarboxylate with dilute barium hydroxide completely hydrolyzed the ester to 4, 4′-dihydroxydiphenic acid.

The following compounds have been prepared and have not been reported in the literature:

Diethyl 4, 4′-dihydroxydiphenate
Dimethyl 4, 4′-dihydroxydiphenate
4, 4′-Diacetoxydiphenic anhydride
4, 4′-Dimethoxydiphenic anhydride
4, 4′-Diacetoxy-2-carbethoxy-2′-biphenylcarboxylic acid
Ethyl 4, 4′-diacetoxy-2-chloroformul-2′-biphenylcarboxylate
β-Diethylaminoethyl 4, 4′-diacetoxy-2-carbethoxy-2′-biphenylcarboxylate
2-Carbethoxy-4, 4′-dimethoxy-2′-biphenylcarboxylic acid
Ethyl 2-chloroformul-4, 4′-dimethoxy-2′-biphenylcarboxylate
β-Diethylaminoethyl 2-carbethoxy-4, 4′-dimethoxy-2′-biphenylcarboxylate

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2. Maass, A. R.; Smith, Kline and French pharmacology report included in letter to R. H. Blythe, August 13, 1952; copy of the letter in the personal file of Dean G. L. Jenkins, Purdue University, W. Lafayette, Ind.

69 pages. $1.50. Mic 57-249

THE ASSAY OF CARDIOTONIC DRUGS BY A CHICK EMBRYO METHOD

(Publication No. 17,791)

Gordon Henry Bryan, Ph.D.
University of Maryland, 1956

Supervisor: Professor Casimir T. Ichniowski

Because Digitalis is assayed by biological methods, it was of interest to determine whether or not 72-hour chick embryos could quantitate digitalis and its commonly used glycosides.

The procedure was similar to that established by Bryan and Waldon (1951) who found a dose-percent response relationship using intact in situ 72-hour embryos with topical application of cardiotonic drugs in solution.

Ventricular standstill of the embryonic hearts was used as the end point. Observations were timed from the onset of drug application, and the results read after 900 seconds. The quantal effect was then expressed as percentage response.

Using thirty embryos per dose, characteristic curves were established for seven drugs used in the study. These curves identified the proper dosage range for bioassay and in addition allowed a qualitative comparison of the seven drugs.

Repeated trials with ten embryos per dose and a three dose design for each drug were made. The results were plotted on log probit paper. The slope, its standard error, and the LD_{50} and its standard error were calculated for each trial by the method of Finney (1952). A comparison

of slopes for each series was made by the method of Miller, Bliss, and Braun (1939) to determine whether parallelism existed between the results of different days for the same drug.

Since the data indicated that fixed dosages could be used for each drug, the method was considered satisfactory for assay purposes.

Unknown samples furnished by Dr. C. T. Ichniowski were quantitated for six of the drugs using a three x three assay design with ten embryos per dose level.

By inspection of the characteristic curves it was determined that the embryos responses to gitalin, digitoxin, strophanthin, ouabain, and digitalis were sigmoid. The data obtained from the administration of acetyldigitoxin was logarithmic in form, and from this it was deduced that the embryo responses to acetyldigitoxin was qualitatively different than the other drugs. Attempts to use an eighth drug, lanatoside C, failed because of solubility limitations.

All unknown samples were assayed within 10% of the true value with the exception of a diluted digitalis tincture and ouabain. These discrepancies were not investigated further. Acetyldigitoxin was not assayed due to a limited supply.

The embryo data from the repeated trials with digitalis, digitoxin, digoxin, and gitalin were combined by the method of Miller, Bliss, and Braun (1939). As a corollary these combined values were then compared to digitalis as the reference drug and to human oral digitalizing and maintenance doses for potency ranking. The embryo comparisons of digitoxin and digoxin were in good agreement with the oral maintenance dose for humans. However, gitalin was shown to be approximately twice as potent as digoxin which did not agree with the human ranking. Humans demonstrate gitalin and digoxin to be of equivalent potency when these drugs are administered orally for maintenance purposes. 50 pages. $1.50. Mic 57-250

A PHARMACOLOGIC AND TOXICOLOGIC STUDY OF A NEW SERIES OF ANTISPASMODIC COMPOUNDS WITH SPECIAL REFERENCE TO STRUCTURE AND PHARMACOLOGIC ACTIVITY

(Publication No. 17,792)

Harold Horn Bryant, Ph.D.
University of Maryland, 1956

Supervisor: Dr. John C. Krantz, Jr.

The pharmacologic and toxicologic characteristics of a new series of amino ethers related to bromsaligenin have been studied. Special attention was given to chemical structure as related to pharmacologic activity, rate and extent of absorption and duration of effect following oral administration. The acute toxicity in mice and rats was determined both orally and intraperitoneally and found to be relatively low. Chronic toxicity was studied on two members of the series in three species—rats, mice and guinea pigs. All three species tolerated ten times the estimated maximum daily intake in man, over a period of six months, without evidence of toxic effects, either grossly or histologically.

The pharmacologic studies of these compounds upon smooth muscle of the gastrointestinal tract indicate a marked antispasmodic activity. This inhibitory effect is exhibited either with excised muscle strips or in situ. The passage of a standard charcoal meal in fasted rats and mice was markedly decreased by oral administration of a number of these compounds. The stomach activity was likewise reduced as shown by significant extension of stomach emptying time. The duration of the inhibitory effects as observed upon the stomach was several times that shown by atropine sulfate. These effects were directly related both in degree and duration to the length of the alkoxy chain on position two of the ring. Increasing the number of bromine atoms on the ring also enhanced the antispasmodic activity.

Three members of the series, representing the salient structural variants, were shown to exhibit no significant effect upon salivation or mydriasis in doses far in excess of the estimated maximal human intake. The cervical sympathetics of the cat were unaffected. The fleeting depressor response characteristically elicited in the dog was not abolished by autonomic blockade. The full response remained after injection of atropine, nicotine, Etamon, and priscoline, as well as after capillary poisoning with large doses of arsenate. Trephining of the dog failed to inhibit the depressor response.

It is concluded that these compounds are relaxants, especially to smooth muscle of the gut, acting directly upon the muscle cells. This action then differs from that of atropine and other atropine-like compounds in that antispasmodic activity does not depend upon impaired nerve function. It appears that certain members of the series might be useful in the treatment of hypermotility of the gastrointestinal tract. 133 pages. $1.80. Mic 57-251

A MEASUREMENT OF THE STABILITY OF DILUTE SUSPENSIONS BY MEANS OF OPTICAL DENSITY

(Publication No. 18,841)

John Aloysious Devaney, Ph.D.
Purdue University, 1956

Major Professor: H. George DeKay

In the past the methods of evaluating pharmaceutical suspensions were for the most part subjective in nature. Those who reported results in terms of some technique of measurement invariably reported the results obtained on the overall finished product. It was difficult to explain observed differences in terms of some fundamental property of the suspension because generally only one variable was measured. The other variables were either assumed to be constant or not considered at all.

It was the purpose of this thesis to study the effect of various agents on the stability of suspensions under controlled conditions so that observed differences could be directly attributable to one variable, since the other variables were measured and shown to be constant.

The variables of the system are those of Stokes Law; the radius of the particles in suspension, the density of the suspending medium, the density of the suspended powder and viscosity. The density of the suspending medium and the viscosity were measured and shown to be essentially

constant. The density of the suspended powder was assumed to be constant since the same powder was used throughout the entire work. The independent variable was some physical or chemical property of the suspending agent and the dependent variable was the radius of the particles in suspension.

Dilute suspensions, 30 mg./100 cc., of zinc oxide or kaolin and low concentrations of suspending agents were used so that appreciable changes in optical density would take place within a relatively short period of time.

The rate of sedimentation was determined indirectly by measuring the change in optical density with time. If a monodispersion were being analyzed, the optical density would remain a constant, since the number and size of the particles entering the field being analyzed would equal the number leaving. However, the further removed the dispersion was from a monodispersion the greater would be the change in optical density with time.

Since zinc oxide normally is dispersed in water as aggregates and single particles, it is possible to determine the degree to which the suspending agent is capable of breaking apart the aggregates by comparing the rates of change of optical density of the suspending agent sample with that of a control of zinc oxide and water. The more efficient the suspending agent is at breaking up the aggregates, the closer the suspension will approach that of a monodispersion. Thus it may be possible to explain unexpected differences in rates of settling in terms of the ability of the suspending agent to break apart the aggregates.

The following suspending agents were tested with zinc oxide: carboxymethyl cellulose - H.V., methyl cellulose - 4,000 cps., sodium alginate, tragacanth, bentonite, veegum and acacia, and the results were compared with a control containing no suspending agent.

The effect of the suspending agent on the degree of aggregation within the zinc oxide suspensions was offered as a possible explanation for the different rates of settling observed in the zinc oxide samples.

To determine whether this effect could also be demonstrated with another powder in suspension, the same procedures were followed for kaolin suspensions with the following suspending agents: carboxymethyl cellulose - H.V., methyl cellulose - 4,000 cps., sodium alginate, tragacanth, bentonite, pectin and acacia.

Different rates of settling were again observed. It was significant that the same suspending agent did not produce the same effect in the zinc oxide and kaolin suspensions. This would imply a specificity between the suspending agent and the powder in suspension.

Electolytes and surfactants were also capable of influencing the rate of settling and were offered as possible mechanisms for breaking up the aggregates.

From the experimental results obtained it could be concluded that suspending agents, electrolytes and surfactants are capable of influencing the degree of aggregation of a powder in a suspension, therefore affecting the rate of sedimentation.

The ability of a suspending agent to influence the rate of sedimentation is specific for the system under consideration. A definite suspending agent may be best for one powder in suspension and not for another.

Suspensions of a substance made with different suspending agents may have the same viscosity and density but yet different stabilities. It has been shown that the suspending agent which produces the best suspension is the one which is capable of reducing the size of the aggregates.

The relatively short period of time necessary to make a determination makes it possible to evaluate more samples and check reproducibility.

90 pages. $1.50. Mic 57-252

A STUDY OF BIOLOGICAL METHODS FOR THE EVALUATION OF NON-NARCOTIC ANALGESICS (PARTS I AND II)

(Publication No. 18,902)

Robert Desmond Gibson, Ph.D.
Purdue University, 1954

Major Professor: Leroy D. Edwards

This investigation was undertaken to devise a laboratory screening method for the non-narcotic analgesics which would provide a more sensitive procedure than is presently available.

The effect of pain and analgesics on the blood sugar level and gastric secretion of the guinea pig were studied. Preliminary investigations were also undertaken to determine the applicability of using the renal clearance in the rat for the evaluation of analgesia.

The results of these preliminary studies provided little information that could be directly associated with the relief of pain. The technics necessary for the measurement of physiological changes appear too involved to provide a practical screening procedure.

A device, consisting of a contact rectal electrode, and an indifferent electrode was found to be sufficiently sensitive to detect changes in response to an electrical stimulus produced in rats by non-narcotic analgesics.

The minimum effective doses and their relative analgesic potencies as compared to acetylsalicylic acid are as follows: acetylsalicylic acid, 450 mg./Kg., 1; acetophenetidin, 750 mg./Kg., 0.6; sodium salicylate, 600 mg./Kg., 0.75; aminopyrine, 450 mg./Kg., 1; acetylsalicylic acid with aluminum glycinate and magnesium carbonate (Bufferin(R)), 300 mg./Kg., 1.5; sodium acetylsalicylate, 150 mg./Kg., (dose calculated on the basis of acetylsalicylic acid), 3; acetanilid, 100-150 mg./Kg., 4.5-3.0; salicylamide, 75 mg./Kg., 6; antipyrine, 75 mg./Kg., 6, all administered orally; and morphine sulfate, 5 mg./Kg., subcutaneously, 90. 94 pages. $1.50. Mic 57-253

STUDIES ON CERTAIN PHASES OF THE LABORATORY AND FIELD CULTIVATION OF CLAVICEPS PURPUREA (FRIES) TULASNE (PARTS I AND II)

(Publication No. 18,903)

Gunnar Gjerstad, Ph.D.
Purdue University, 1954

Major Professor: Dr. Egil Ramstad

Claviceps purpurea (Fries) Tulasne has been studied on semisolid synthetic substrates as well as in submerged cultures and on its natural host.

1. The influence of several added chemicals related to indole, on the growth, morphological appearance, and alkaloid formation is reported. The same compounds were also tested in combination with certain pyridine derivatives and aliphatic acids, which, according to a suggested theory on alkaloid biosynthesis, might be metabolized by the fungus into lysergic acid and the ergot alkaloids.

The tested compounds included specifically:

Indole-3-acetic acid	Guvacine Hydrochloride
Indole-3-aldehyde	Citric acid
Gramine	Citraconic anhydride
Tryptophan	Glutamic acid
Tryptamine Hydrochloride	Itaconic acid
Trigonelline	Furoic acid
Arecoline Hydrochloride	Acetic acid
Nicotinic acid	Formic acid

No alkaloids were detected in the formed hyphae or in the filtered broth.

2. The influence and the toxicity of certain amino acids were also studied. These have been reported to make up the protein of rye: gliadin.

dl-Tryptophan	dl-Valine
1(+) Glutamic acid	dl-Phenylalanine
l-Proline	α-Alanine
dl-Leucine	1(+) Histidine Hydrochloride

None of these acids were toxic to Claviceps in the employed concentrations; neither did they induce alkaloid formation.

3. Natural substrates were tested, likewise extracts of ergot and ergot screenings. The first one did not support growth of Claviceps; neither of them did promote alkaloid formation.

Water-insoluble ergot alkaloids and biogene amines found in ergot, were also incorporated into the media. We were not able to verify the finding of some previous workers that added alkaloids are metabolized completely by the fungus within a growth period of 30 days. The other compounds did not induce alkaloid formation.

4. Inorganic compounds were incorporated into some media. They exercised some influence on growth, but did not bring about alkaloid formation.

5. It was found that extracts of rye tissues, derived with different solvents and according to different procedures did not support the growth of Claviceps in vitro, unless substantial quantities of carbohydrates, amino acids and other supplementary feedings were added.

6. The influence of higher temperatures, decreased oxygen tension and various changes in the osmotic pressure was studied. The maximal growth conditions in these respects are reported.

7. Since Claviceps purpurea failed to produce alkaloids under any of the reported conditions in artificial cultivation, the fungus was studied when grown parasitically on Secale cereale L., var. Balbo Tennessee.

The formation, some chemical constituents and microscopical characteristics of honeydew are described. No alkaloids, lysergic acid type compound, starch or steroidal substances were detected in any sample of honeydew.

8. The formation of sclerotia are described in some detail. Illustrations of normal and unusual types of sclerotia are given. A strict correlation was found between anatomical micro-morphology and alkaloid production. No interdependence seemed to exist between pigment and alkaloid formations.

It is asserted that Claviceps purpurea (Fries) Tulasne will produce alkaloids in the sclerotial stage of metamorphosis, and only when normal, hard sclerotial tissues are produced. It is believed that Claviceps will form alkaloids on synthetic media, if the natural life cycle can be achieved under artificial growth conditions, and if sclerotia, displaying the illustrated morphological characteristics, are formed. 114 pages. $1.50. Mic 57-254

TACHYPHYLAXIS TO AMINES IN ISOLATED VASCULAR STRIPS

(Publication No. 19,699)

Leland Clifford Hendershot, Ph.D.
University of Michigan, 1956

The study of tachyphylaxis in isolated vascular tissue offers the advantage of being able to observe adaptive phenomena in the absence of extrinsic neural or humoral influences, diminished contractile responses following repeated administration of drugs being dependent upon cellular changes in the treated tissue.

Ephedrine, histamine, Pitressin, 5-Hydroxytryptamine, and tyramine were administered repeatedly to spirally cut strips of dog carotid artery and rabbit aorta suspended in Krebs-Henseliet solution. Contractions were recorded kymographically.

Tachyphylaxis developed to ephedrine, histamine and Pitressin in dog carotid but not in rabbit aortic strips and to 5-Hydroxytryptamine (Serotonin) and tyramine in rabbit aortic but not in dog carotid arterial strips. No cross tachyphylaxis occurred and strips tachyphylactic to one compound remained sensitive to the others and to epinephrine. However, tachyphylaxis can be established first to one drug and then to another in the same strip. Although reversal of tachyphylaxis took place in the presence of sodium deficient medium, subsequent administration of the drug to the strip immersed in medium with the proper level of sodium showed that tachyphylaxis was not permanently reversed and, in fact, had continued to progress in the presence of the low sodium medium. Surface active agents enhanced tachyphylaxis. There was a direct relationship between the ease of development and rate of disappearance of tachyphylaxis. In the dog carotid arterial strip complete tachyphylaxis to histamine was developed and lost quickly while ephedrine tachyphylaxis was rarely complete and was developed and lost slowly. Strips treated with C-14 labeled tyramine retained significant

amounts of the drug even following extraction with 0.5N HCl. In cases where no tachyphylaxis occurred (e.g. histamine-treated rabbit aorta) reproducible or augmented responses occurred, fatigue being minimal or absent.

It can be concluded that: (1) the tachyphylaxis to each of the compounds studied is specific to itself and that each acts upon its specific receptor; (2) the theory of receptor occupation as a mechanism of tachyphylaxis remains tenable. 131 pages. $1.75. Mic 57-255

COMPRESSION OF CRYSTALLINE SUBSTANCES

(Publication No. 17,805)

Jonah Jaffe, Ph.D.
University of Maryland, 1956

Supervisor: Dean Noel E. Foss

A study has been made of various substances and their ability to form tablets when subjected to direct compression. A relationship appeared to exist between binary compounds and the property of tablet formation. Water of crystallization was found to act as a "built-in" binding agent in various substances. Its removal prevented tablet formation.

A study of hardness values of the tablets obtained showed that these values were not related to the density of the substances compressed. A table of the relative tablet hardness values of several substances was prepared. The hardness the tablet achieved appeared to be related to the boiling point of the substance. Substances with higher boiling points formed harder tablets.

Substances containing the sulfate or carbonate radical showed a poor tendency to form tablets. No definite pattern appeared upon comparison of "crystalline" and "powdered" substances and their ability to form tablets. Substances forming structurally neutral layer lattices did not tend to form tablets. 38 pages. $1.50. Mic 57-256

THE STABILITY OF SODIUM PARA-AMINOSALICYLATE IN AQUEOUS SOLUTION

(Publication No. 17,808)

Chalres Joseph Kokoski, Ph.D.
University of Maryland, 1956

Supervisor: Dean Noel E. Foss

Sodium para-aminosalicylate in aqueous solution undergoes rapid decarboxylation (meta-aminophenol formation) and darkening. A study of decarboxylation and darkening of sodium para-aminosalicylate solutions and darkening of meta-aminophenol solutions was undertaken with the purpose of attempting to stabilize solutions of sodium para-aminosalicylate. The amount of meta-aminophenol produced by decarboxylation of sodium para-aminosalicylate was determined by the method described by Seaman on a Beckman Spectrophotometer, Model D. U.

Since carbon dioxide is evolved in the decarboxylation of sodium para-aminosalicylate, solutions of sodium para-aminosalicylate were sealed with carbon dioxide gas under pressure in the belief that excess carbon dioxide would drive the decarboxylation reaction in reverse. However, solutions sealed under carbon dioxide gas under pressure resulted in an increased rate of decarboxylation. Sodium bisulfite and sodium formaldehyde sulfoxylate prevented darkening but accelerated the rate of decarboxylation of sodium para-aminosalicylate solutions. Decarboxylation and darkening were not reduced by N D G A, Sustane #1-F, Melilotin, Ethyl Hydrocaffeate. Buffering solutions of sodium para-aminosalicylate to a more alkaline pH utilizing either potassium acid phosphate-sodium hydroxide or sodium borate resulted in a somewhat higher rate of decarboxylation and darkening; addition of favorable antioxidants failed to reduce decomposition.

No changes occurred in the spectral curve of color of meta-aminophenol in aqueous solution when assayed according to the method described by Seaman periodically for seven months. However, the original solutions turned dark and formed a black precipitate. Sodium bisulfite and sodium sulfite prevented darkening of the meta-aminophenol solutions.

The displacement of air with nitrogen gas inhibits darkening of sodium para-aminosalicylate solutions but does not inhibit decarboxylation. Versene Na_4, sodium sulfite, Versene Na_4 in combination with sodium sulfite, and n-isopropyl ethylenediamine reduced darkening and decarboxylation. Versene Na_4, 0.05%, in combination with sodium sulfite, 0.1%, reduced the rate of decarboxylation of sodium para-aminosalicylate solutions approximately 75% and prevented darkening both under nitrogen and under air. 43 pages. $1.50. Mic 57-257

PHYSICS, GENERAL

ACOUSTIC STREAMING NEAR A CAVITATION BUBBLE*

(Publication No. 19,522)

Samuel Adams Elder, Ph.D.
Brown University, 1956

In this thesis experimental information has been gained on both the sound fields and acoustic streaming patterns generated by a vibrating bubble which rests on a plane boundary. Such information is basic to understanding situations in sonics or ultrasonics where cavitation takes place; cavitation bubbles usually form on solid boundaries, especially if corners or crevices are present.

The sound pressure field near the bubble was explored with a small calibrated probe, the data being interpreted in such a way as to distinguish the sound wave actually scattered from the bubble from the "incident" (driving) wave in the chamber. A check on these results was obtained by deriving the scattered pressure from the observed displacement amplitude of the bubble surface. A critique of the measurement techniques is given in the Appendix.

In spite of the complexity of the theoretical problem of a non-spherical bubble on a rigid boundary, the results on (i) the ratio of scattered to incident pressure, and (ii) the bubble volume corresponding to resonant size, seem to agree surprisingly well with a theory slightly modified from that for a spherical bubble in an unbounded medium.

The streaming fields consist, on the whole, of orderly patterns, often with symmetry about a vertical axis through the center of the bubble. The patterns depend, for a given frequency, on the viscosity of the liquid and on the amplitude of the bubble vibration. Four separate regimes of streaming may be observed.

"Source" mechanisms for the generation of the streaming are discussed. Several aspects of the problem appear to be important: (1) interaction of the bubble-scattered spherical wave with the plane boundary; (2) special physical properties of the bubble surface as affected by contaminants; and (3) the influence of surface ("capillary") vibrating modes. 134 pages. $1.80. Mic 57-258

*This work was supported jointly by the U.S. Air Force and the Off. of Naval Res.

STUDIES OF THE ANNIHILATION OF POSITRONS IN GASES

(Publication No. 19,631)

Milton Heinberg, Ph.D.
University of Pittsburgh, 1956

The study of the process of positron annihilation by measurement of the angular correlation of the two quanta from the annihilation event has for the first time been extended to include the annihilation of positrons in gases. The experiments were undertaken to study the annihilation process in various gases some of which do not destroy any triplet positronium that is formed.

In this work, the distribution in angle is usually limited to within ten milliradians of 180^0 with particular attention to the effect of a d.c. magnetic and/or a d.c. electric field on the events within two milliradians of 180^0.

The magnetic quenching of ortho-positronium done previously in various gases has been extended to higher fields. For argon it was found that the field dependence of the rate at the peak ($\theta = 0$) of the angular distribution obeys the curve for the quenching of free positronium. For all other cases (SF_6, N_2O, N_2 and mixtures of argon with O_2, NO, or N_2) it was found that there was some mechanism competing with the magnetic field. The mechanism is perhaps electron exchange collisions. In all gases tested, except argon, positronium was found to be thermalized before the annihilation event. The thermalization time of positronium in ideally pure argon was found to be greater than 9×10^{-9} sec. Some preliminary evidence for the existence of the $n = 2$ states was found but the evidence was not conclusive.
47 pages. $1.50. Mic 57-259

THE X-RAY K-ABSORPTION SPECTRUM OF COPPER

(Publication No. 17,512)

Reuben Stanley Krogstad, Ph.D.
State College of Washington, 1955

A detailed investigation of the K-absorption edge of copper with a high resolution double crystal x-ray spectrometer has revealed considerable low intensity structure in the edge itself. Also, some structure has been observed on the low energy side of the main edge.

The structure found in the edge agrees closely with a similar structure reported by Hayasi.

So far as the writer is aware, the structure on the long wave-length side of the main edge has not been previously observed. Arguments are advanced attributing this low energy structure to electron transitions in which exciton levels are the final states.

Measurements on the extended absorption fine-structure of copper were carried out to about three hundred volts from the main edge. The only previously reported extended structure has been obtained with single crystal instruments using photographic registration. The results of the present study were compared with earlier investigations in an attempt to determine the cause of the discrepancies in the published extended structure measurements. A comparison was also made with the theoretical predictions of Kronig and Hayasi and the present experimental results on the extended fine-structure.
43 pages. $1.50. Mic 57-260

THE K X-RAY ABSORPTION SPECTRUM OF GERMANIUM

(Publication No. 17,514)

William Frank Nelson, Ph.D.
State College of Washington, 1956

An investigation was made of the K x-ray absorption spectrum of germanium. The germanium was in the form of a large single crystal used simultaneously as a reflecting diffractor and absorber. The germanium crystal was employed as the diffractor in a single-crystal spectrometer and as the second crystal in a double-crystal spectrometer. Geiger-counter intensity registration was utilized in the double-crystal work while both geiger-counter and photographic intensity registration were used in the single-crystal runs.

For the double-crystal work, an attempt was made to find a suitable crystal to polarize the x-rays at the germanium K-edge wave-length in order to evaluate the Kronig hypothesis for the origin of the fine structure frequently observed on the short wave-length side of the absorption edge. However, this attempt was unsuccessful.

A value of 1114.3 x.u. was measured for the location of the germanium K-absorption edge, in good agreement with earlier work. In addition, the results indicate that the structure observed appears to be independent of the method of intensity registration.

Contrary to what might be expected on the basis of previous work, very little structure was observed in the double-crystal investigations and none in the single-crystal investigations. None of the structure observed extended beyond 25 volts from the main edge.

It is suggested that the failure to observe any extended structure is due to the peculiarity of utilizing the absorber in a reflection rather than transmission capacity. As far as the author is aware, almost all of the extended structure which has been observed was found using the absorber as a transmission absorber. Thus it appears that the effects of the peculiarities of a particular experimental arrangement upon the absorption fine structure should be critically assessed in interpreting the results.

76 pages. $1.50. Mic 57-261

VIBRATIONAL SPECTRA OF COMPOUNDS IN DIFFERENT STATES OF AGGREGATION

(Publication No. 19,500)

Alva Taylor Stair, Jr., Ph.D.
The University of Oklahoma, 1956

Supervisor: J. Rud Nielsen

While it is usually most convenient to study the vibrational spectra of a compound in the liquid state, more information can be derived from the spectra of the gaseous phase, in which the intermolecular forces are negligible, and from the spectra of the crystalline phase, in which the intermolecular forces exhibit regularities depending on the crystal structure, and in which the molecules do not rotate. The aims of the present work have been to develop equipment and techniques for obtaining the Raman spectra of volatile compounds at low temperatures and to obtain and interpret the infrared and Raman spectra of selected compounds in different states of aggregation.

A low-temperature Raman irradiation apparatus was developed consisting of a special Dewar flask with plane windows containing a vacuum-jacketed Raman tube. The Dewar is surrounded by a helical mercury lamp mounted in a box with diffusely reflecting walls. With liquid nitrogen as a coolant any temperature between -190°C and room temperature can be maintained. An auxiliary device makes it possible to grow a single crystal from a melt in the Raman tube.

Before this equipment was completed the Raman spectra of liquid and crystalline trioxane, and the infrared spectrum of the vapor, were investigated. The fundamental vibrational frequencies of the trioxane molecule (symmetry C_{3v}) were assigned as follows: species a_1: 2853, 2792, 1496, 975, 943, 752, and 524 cm^{-1}; species e: 3031, 2753, 1477, 1407, 1300, 1175, 1072, 1041, 462 and 307 cm^{-1}; species a_2: ~1350, ~1250, and ~1185 cm^{-1}. More than half of these assignments differ from those of previous investigators.[1,2,3] A single crystal of trioxane (space group C_{3v}^6) was grown, and its Raman spectrum was obtained. Two of the e fundamentals were found to split.

The Raman spectra of ethylene oxide and dimethyl ether in both liquid and solid states and of sulphur hexafluoride in the crystalline state were obtained with the low-temperature apparatus. Unfortunately, the crystal structure is not known for any of these compounds. A few new Raman bands were observed in the liquid state for both ethylene oxide and dimethyl ether. The spectra of the crystals, which had not been obtained previously for either, are very similar to the spectra of the liquids.

Since only the strongest of the Raman-active vibrations of sulphur hexafluoride had been observed previously,[4,5] the Raman spectrum of SF_6 gas was investigated with a newly-constructed irradiation apparatus.[6] Three bands were found, at 769.4, 639.5, and 522 cm^{-1}, which must undoubtedly be interpreted as a_{1g}, e_g, and f_{2g} fundamentals, respectively. In addition, a weak Raman band was found at 690 cm^{-1} which is interpreted as the overtone of the Raman- and infrared-inactive f_{2u} fundamental. The three fundamentals were also observed, essentially unchanged, in the Raman spectrum of crystalline SF_6. In addition, two new bands were observed at 505 and 543 cm^{-1} indicating a splitting of the triply degenerate f_{2g} fundamental.

87 pages. $1.50. Mic 57-262

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SHORT RANGE PROPAGATION OF SOUND IN SHALLOW WATER

(Publication No. 17,824)

Marvin S. Weinstein, Ph.D.
University of Maryland, 1956

Supervisor: Dr. Roald K. Wangsness

The propagation of sound in shallow water has been studied both theoretically and experimentally. The detailed design of a test facility for the purpose of obtaining laboratory data under controlled conditions is described. For the case of an acoustically liquid bottom (water saturated sand), measurements have been made at frequencies ranging from 10 to 30 kilocycles per second in water depths of 1/2 to 2 feet. The point source of sound was located midway between the surface and bottom while the field point was located on the bottom at horizontal ranges up to 15 inches. It has been found that the image form of the Pekeris solution is in excellent agreement with the experimental results for ranges which are short enough for the incident angle associated with the first bottom image to be less than the critical angle for the plane wave reflection coefficient. In the vicinity of the critical range, and for longer ranges, the less accurate ray theory yields results which are considerably more accurate than Pekeris implies. For the case of an elastic solid bottom (a Portland cement and sand mortar) similar measurements were made at 20 kilocycles per second in 2 feet of water. The results indicate that the shear waves excited in the bottom must be included in the theoretical computations. The ray theory then yields results in excellent agreement with experimental data except in the vicinity of the range for which the incident angle for the first bottom reflection is equal to the critical angle for longitudinal waves in the plane wave reflection coefficient.

80 pages. $1.50. Mic 57-263

PHYSICS, ELECTRONICS AND ELECTRICITY

TRANSIENT PHENOMENA IN TRAVELING-WAVE TUBES

(Publication No. 19,914)

Alan Vance Brown, Ph.D.
Stanford University, 1956

When the r-f input signal to a traveling-wave tube is pulsed on, and the electron beam in the tube is in a steady-state condition, the rise time of the tube's output signal can be calculated with a knowledge of the tube's steady-state response versus frequency characteristic. This calculation is performed for both the forward-wave and the backward-wave amplifier.

For the case with the r-f signal applied continuously to the circuit of a helix-type forward-wave amplifier and the electron beam pulsed on, transient effects of a time duration of 0.2 μs have been observed experimentally. It is shown that the pulsed beam impresses a video signal on the helix, which causes the helix to ring. Due to the ringing phenomenon, the beam is placed out of synchronism with the circuit wave, thereby distorting the r-f output signal. Under suitable operating conditions a minimum rise time of less than 20 mμs was obtained. No theoretical investigation of this phenomenon was undertaken.

Calculations of the beam-front distortion due to its transit down the length of the circuit were carried out. They predicted, for most conventional tubes, a collector-current rise time of less than a fifth of a beam transit time. Experimental results agreed with the theory to within a factor of two.

An investigation of the build-up process in backward-wave oscillators was performed. The theoretical results, based on a small-C linear theory, show reasonable agreement with the experimental results. The experimental results indicated build-up times of 2.5 to 0.1 μsec for an S-band oscillator, as the tube's beam current was varied from 1.1 to 2.4 times its start-oscillation value.

Fourier and Laplace transformation methods were used in the theoretical investigations. The difficulties, usually encountered when applying transformation calculus methods to distributed circuits, were considerably reduced by approximating the tube's response function before evaluating the inversion integral.

121 pages. $1.65. Mic 57-264

MICROWAVE MEASUREMENTS ON GERMANIUM SEMICONDUCTORS

(Publication No. 18,840)

Frederick A. D'Altroy, Ph.D.
Purdue University, 1956

Major Professor: H. Y. Fan

Transmission measurements were made on germanium semiconductors in the microwave frequency region, from which the conductivity and dielectric constant were determined. The dielectric constant was found to depend on temperature and carrier concentration. From the conductivity and the contribution to the dielectric constant due to the free carrier polarization, values for the relaxation time and effective mass of the carriers were calculated. For P-type germanium in the temperature region of 20 to 300°K, the relaxation time was found to obey the same temperature dependence as the Hall mobility and the effective mass was constant ~0.34 m_0. For N-type germanium, on the other hand, the effective mass decreased with temperature from 0.59 m at 300°K to 0.16 at 20°K.

At 4.2°K, measurements were made on highly doped germanium of both P and N-types. An increase in the dielectric constant was observed which was attributed to polarization of charges bound on neutral impurities. From the polarizability, estimates were made of the activation energies, E, of Ga and Sb at different concentrations. ΔE was found to be lower at higher impurity concentration.

Estimates were also made of the effective mass of the carriers, giving k a lower limit of ~900 m for these samples. The large value supports the hypothesis of impurity band conduction. 104 pages. $1.50. Mic 57-265

HIGH FREQUENCY RESONANCES IN FERRITES

(Publication No. 19,509)

Kent D. Lawson, Ph.D.
Rensselaer Polytechnic Institute, 1956

Research Professor: Dr. H. B. Huntington

The components of the complex permeability of a pure and an impure nickel-zinc ferrite have been determined from 1 to 920 megacycles per second by bridge and slotted-line methods. Previous investigations of high-frequency dispersions in ferrites have shown, under certain conditions, that changes in the values of the initial permeability and the resonant frequency correlate with the porosity. However, in each of these earlier investigations an uncontrolled variable made the results ambiguous. In this work, the porosity of a nickel-zinc ferrite decreases about 30 percent with the addition of 1/2 mole percent vanadium pentoxide. The initial permeability is about doubled and the frequency of maximum absorption is about halved. The results agree with Snoek's use of domain spin rotation as the mechanism responsible for the dispersion. There is some evidence for superimposed secondary resonances. A generalized derivation and technique for the determination of the VSWR by slotted-line methods is presented.

An indirect method of X-ray diffraction analysis supports a hybrid structure for the pure ferrite and suggests that the impure ferrite might have two new types of structure, with nickel and zinc either both on tetrahedral sites or both on octahedral sites.

103 pages. $1.50. Mic 57-266

SUPERCONDUCTING PROPERTIES OF MICROSCOPIC TIN FILAMENTS

(Publication No. 17,812)

Olin Silas Lutes, Jr., Ph.D.
University of Maryland, 1956

Supervisor: Professor Ferdinand G. Brickwedde

An experimental determination has been made of the magnetic fields necessary for the destruction of superconductivity in microscopic tin filaments called "whiskers." For temperatures near the zero-field transition temperature, T_c, the results are unambiguous, and in this region the critical fields are found to be significantly higher than those of a large superconductor. At lower temperatures the critical field curve splits into two parts, the upper curve giving the field for destruction of superconductivity and the lower curve giving the field for restoration.

The critical field data for temperatures near T_c have been analyzed by use of the London equation for superconductors. According to this equation the properties of a superconductor are characterized by a size-invariant parameter, λ. For bulk specimens the London λ becomes identical with the magnetic penetration depth. For small specimens it is possible to determine λ by applying the predictions of the London equation to the measured values of critical field. The extent of agreement of λ, so determined, with the bulk penetration depth indicates the extent of validity of the London equation. The present results show λ to be greater than the accepted value, λ_∞, of the penetration depth in pure bulk tin by a factor which is nearly constant, for a given whisker, over the useful range of temperature. Thus the temperature variation of λ agrees with that of λ_∞. The magnitude of λ is found to depend upon the electrical conductivity of the individual whisker determined from the change in resistance at the superconducting transition. The dependence on normal conductivity, or mean free path, is such that in the limit of long mean free path λ approaches λ_∞. As a consequence of these considerations it is concluded that the critical field data are in agreement with the London equation, providing the penentration depth in tin depends upon the mean free path according to the simple relation: $\lambda = \lambda_\infty [1 + (\ell_0/\ell)]^{\frac{1}{2}}$, where ℓ is the mean free path and $\ell_0 = 1.3 \times 10^{-4}$ cm. The electrical properties of the normal metal are thus introduced directly into the London equation for superconductors.

The disappearance of hysteresis, i.e. the joining together of the upper and lower critical field curves near T_c, represents behavior different from that observed in large specimens. It is suggested that this phenomenon is due to a variation with temperature of the dimensions of the "flaw" at which nucleation of the superconducting state begins. At high temperatures the disappearance of hysteresis corresponds to the coincidence of "flaw" and whisker boundaries. 93 pages. $1.50. Mic 57-267

PHYSICS, NUCLEAR

AN INVESTIGATION OF THE LOW-LYING LEVELS IN O^{18}

(Publication No. 19,678)

David Rudolph Bach, Ph.D.
University of Michigan, 1956

The characteristics of the excited states of O^{18} are of interest because the nucleus consists of a two nucleon system outside the doubly magic O^{16} core. Predictions can be made of the spins, parities, and excitation energies of the excited states by application of nuclear spectroscopic techniques. Comparison with experimental measurements can be expected to restrict the types of nucleon-nucleon interaction potentials by which the system can be described.

LiOH targets enriched in O^{17} and O^{18} were made by forming the hydroxide from thin layers of evaporated lithium using enriched water made by explosion of oxygen with hydrogen. These targets were bombarded with 7.8 Mev deuterons produced by the University of Michigan cyclotron. Proton and deuteron spectra were obtained at several scattering angles by means of nuclear plates placed in the image plane of a double focusing magnetic analyzer.

The installation, shimming, and resolution of focusing and analyzing magnets used in conjunction with the cyclotron are discussed. Measurement of an unknown Q value for a nuclear reaction with an accuracy of ± 0.010 Mev is described.

The first excited state of O^{18} at an excitation energy of 1.986 Mev was observed by the reactions $O^{17}(d,p)O_1^{18}$ and $O^{18}(d,d')O_1^{18}$ in agreement with observations made by Ahnlund and Holmgren et al. There is no evidence on the deuteron or proton spectrum for a level reported by the latter at an excitation energy of 2.445 Mev. A previously unreported level was observed at an excitation energy of 3.550 Mev by the reaction $O^{17}(d,p)O_2^{18}$ at the scattering angles 49.7^0 and 58.5^0 and by the reaction $O^{18}(d,d')O_2^{18}$ at 49.7^0 and 68.5^0.

The positive results of this experiment combined with the work of Ahnlund demonstrate the existence of excited states in O^{18} at the excitation energies 1.986 ± 0.014 Mev and 3.550 ± 0.010 Mev. These are the only strong levels in the excitation region from 0 to 3.55 Mev.

Tensor force interaction energies in the jj coupling limit were calculated for the configurations $(d\frac{5}{2})^2$, $(d\frac{5}{2}d\frac{3}{2})$, $(d\frac{5}{2}S\frac{1}{2})$, and $(d\frac{3}{2}S\frac{1}{2})$. Comparison of the theoretical and experimental level schemes demonstrates the failure of the pure jj coupling approximation. The calculation of Elliott and Flowers, which includes configuration interaction in intermediate coupling, is in better agreement with experiment but indicates that further theoretical investigation is necessary. 106 pages. $1.50. Mic 57-268

ANGULAR DISTRIBUTIONS IN THE $O^{16}(d,p)O^{17}$ REACTION, AND THE ENERGY LEVELS OF O^{17}

(Publication No. 19,685)

William Jeffries Childs, Ph.D.
University of Michigan, 1956

The present experiment was undertaken to investigate the properties of the lower excited states of the O^{17} nucleus by means of the $O^{16}(d,p)O^{17}$ stripping reaction. The objectives were: (1) to determine the spin-orbit coupling energy in the ld shell; (2) to measure the parities of the lower excited states of the O^{17} nucleus; and (3) to investigate the validity and usefulness of the stripping theory in the region of virtual levels.

Eight Mev. deuterons from the University of Michigan cyclotron were used to bombard oxygenous targets. Du Pont Mylar $(C_{10}H_8O_4)^n$ film from 0.00025 to 0.00050 inch thick was found to be a satisfactory target material for most of the research. The scattered protons were analyzed by a ninety degree, double-focusing magnet and detected with a proportional counter telescope. A similar detector was used as a monitor.

No new energy levels of O^{17} were found in the present investigation. The angular distributions obtained for each of the seven lowest-lying levels, the highest three of which are virtual, indicate that the neutron is captured with orbital angular momentum 2 for the ground state, and 0, 2, 3, 1, 2, and 3 for the first through sixth excited states, respectively.

The measured parities of the O^{17} levels are interpreted on the basis of the nuclear shell model. With the exception of the measurement on the 3.055 Mev. level, the present results are in good agreement with the information available about the mirror nucleus, F^{17}. The spins and parities of the seven lowest levels of O^{17} are believed to be 5/2 +, 1/2 +, 1/2 -, 7/2 -, 3/2 -, 3/2 +, and 5/2 -, for the states with excitation energies 0, 0.875, 3.055, 3.840, 4.567, 5.09, and 5.229 Mev., respectively.

The fifth excited state, at 5.09 Mev. excitation, is identified as the single particle D 3/2 spin-orbit companion of the D 5/2 ground state, in agreement with the results of elastic neutron scattering experiments. The spin-orbit coupling energy in the ld shell is thus determined to be 5.09 ± 0.02 Mev.

The angular distributions obtained indicate that the stripping reaction is a useful tool even for the investigation of virtual levels. The ambiguity associated with the choice of the nuclear radius is discussed briefly.

115 pages. $1.50. Mic 57-269

PHOTOPRODUCTION OF PION PAIRS IN HYDROGEN

(Publication No. 19,924)

Richard Morris Friedman, Ph.D.
Stanford University, 1956

The photoproduction of single pi mesons from protons has been extensively studied previously. These measurements have been instrumental in the development of meson theory. Further evidence relating to the fundamental pion-nucleon interaction has been obtained by investigating the photoproduction of pairs of pions. Negative pions can only be produced from protons if accompanied by positive pions; i.e., via pion pair production. Thus the existence of the pion pair photoproduction process has been established unambiguously by observing a negative pion signal coming from a liquid hydrogen target bombarded with 500 to 600 Mev bremsstrahlung.

The high energy electron beam from the Stanford linear accelerator was passed through a radiator placed before a styrofoam-jacketed liquid hydrogen target. The resultant pions (+ and -) are energy analyzed by a magnetic spectrometer and are identified via delayed counts after the short duration linear accelerator beam pulse. These counts arise from the beta particles in the π-μ-β decay sequence. Positive pions are counted after having been brought to rest in a large plastic scintillator; only that fraction of negative pions is detected which decay in flight into muons with the muons stopping in the scintillator.

In practice, the ratio of the yields of negative and positive pions from hydrogen was measured so that using the single photoproduction cross sections, absolute values for the pair cross sections could be obtained. Excitation functions based on the yield of 76 ± 4 Mev negative pions at a laboratory angle of 60^0 were obtained. From the kinematic threshold of 410 Mev to 500 Mev no appreciable excitation was found. The cross section then rises sharply. The energy spectra of negative mesons at 60^0 was measured for 575 and 595 Mev bremsstrahlung. These spectra peak at lower meson kinetic energies. The results at 595 Mev were 6.1 ± 1.5, 8.8 ± 1.1, 5.3 ± 0.6 and -0.5 ± 1.0 (in units of 10^{-33} cm^2 / sterad-Mev-effective photon) at mean pion energies of 19 ± 1, 41 ± 2, 76 ± 4, and 115 ± 4 Mev, respectively. The increase as the upper limit of the bremsstrahlung is varied from 400 to 600 Mev in the yield of 76 ± 4 Mev positive pions due to pairs was measured and was $17.7 \pm 2.6\%$ at 600 Mev. The errors are predominantly due to counting statistics.

These results can be compared with the calculations of Cutkosky and Zachariasen based on the Chew-Low theory. The general shape of the measured excitation function and energy spectrum is in good agreement with theory. This indicates a resonance between the positive pion in a P-state and the nucleon. However, the measured absolute cross sections differ from those predicted by the theory by a factor of two. 116 pages. $1.50. Mic 57-270

DISTRIBUTION OF PROTONS FROM $Al^{27}(n,p)Mg^{27}$

(Publication No. 19,527)

Robert Kingsbury Haling, Ph.D.
Brown University, 1956

A study has been made of the protons emitted by an aluminum foil target when bombarded by 14 Mev neutrons. The neutrons were produced by the T(d,n)He reaction using 175 kev deuterons from the Brown University Cockcroft-Walton accelerator. Emitted protons were analyzed by means of 400μ Ilford C2 emulsion plates placed at angles of 30^0, 60^0, 90^0, 120^0, and 150^0 with respect to the incident neutron beam. Clearly resolved groups are observed corresponding to Mg^{27} excitation energies of 1.0 Mev and 3.5 Mev, with some indication of levels at 1.6 Mev, 5.7 Mev and 7.0 Mev. In approximately 10% of the observations the residual nucleus was left in the 3.5 Mev level, while 1% corresponded to the 1 Mev level. Reactions resulting in the ground state of Mg^{27} accounted for less than 1% of the emitted protons. The angular distribution for the 3.5 Mev level appears to be nearly isotropic and that for the total yield suggests some increase in the forward direction. The cross section for this reaction is estimated at 79 $\pm$ 15 mb. The observations reported are consistent with such relevant data from other experiments as are available. A critical evaluation of the various aspects of this study strongly suggests that the predominant mechanism involved in the Al(n,p) reaction is that of compound nucleus formation. 102 pages. $1.50. Mic 57-271

GAMMA-GAMMA ANGULAR CORRELATION STUDIES OF PLATINUM 192, ARSENIC 75, CERIUM 140 AND LANTHANUM 140

(Publication No. 19,701)

William Harold Kelly, Ph.D.
University of Michigan, 1956

A fast-slow coincidence spectrometer with a stable resolving time of 3×10^{-8} seconds was developed. This fast resolving time was obtained by the use of resistance-capacitance coupled feedback amplifiers driving blocking oscillators which, in turn, fed a Garwin type coincidence circuit.

The spectrometer was used to study the angular correlations of the gamma rays emitted during the complicated decays of Ir^{192} to Pt^{192}, Se^{75} to As^{75}, La^{140} to Ce^{140} and Ba^{140} to La^{140}. The measurements made allow the assignments of angular momenta (spins) to many of the excited states of these nuclei and of multipole orders to the transitions between these states.

It was found that the energy levels of Pt^{192} have spins 0, 2, 2, and 4 in the order of increasing energy. The spins of the fourth and fifth excited states could not be assigned unambiguously but were found to lie in the ranges 2 to 5 and 3 to 5, respectively. Multipole orders of the transitions were assigned as follows: 316 kev--quadrupole; 468 kev--quadrupole; 612 kev--quadrupole; and 296 kev--dipole-quadrupole mixture. These assignments were in agreement with those deduced from internal conversion measurements made by other investigators. The results can be interpreted to indicate the Pt^{192} nucleus may be slightly deformed with particle and collective motions interwoven in a complex manner.

The results obtained for As^{75} were ambiguous and did not allow definite spin and multipole order assignments. However, the measurements allow limits to be placed on the energy level spin assignments. The 281 kev level has spin 3/2 or 5/2. The 269 kev and 405 kev states have spins in the range 1/2 to 7/2.

Ce^{140} was found to have energy levels with spins 0, 2, 4, and 3 in the order of increasing energy. The multipole orders were found to be 1.600 Mev--quadrupole; 0.490 Mev--quadrupole; and 0.328 Mev--dipole with some quadrupole admixture. These assignments are in agreement with those made by Bishop et al and Bolotin et al. However, the dipole-quadrupole mixture obtained here lies between those obtained by these investigators. Possible reasons for the differences are discussed. The results obtained are shown to be consistent with predictions made by the shell model.

The decay scheme of La^{140} was determined using summing techniques. This scheme was found to be compatible with a modification of the scheme proposed earlier by Cork and coworkers. The 537 kev gamma ray was found to parallel the other transitions and not precede them. The decay scheme proposed here requires a 0.550 Mev beta transition that has not yet been observed. Angular correlation measurements made on the 162kev-304kev cascade are ambiguous and do not allow definite spin and multipole order assignments. The following spin sequences (in the order of increasing energy) were found to be consistent with the directional correlation data: 4(D,Q)4(Q)2, 4(D,Q)3(Q)1, 4(D,Q)4(O)1, 3(D,Q)2(Q)0, 3(D,Q)3(D,Q)2 and 2(D,Q)2(D,Q)1. Different possible ground state configurations as determined by the shell model are discussed. It is seen that the ground state spin assignment of ≥ 3 is compatible with the shell model.
130 pages. $1.75. Mic 57-272

THE PRODUCTION OF POSITIVE PIONS BY ELECTRONS

(Publication No. 19,931)

Carol Marilyn Newton, Ph.D.
Stanford University, 1956

The first experimental work on the production of pions through the bombardment of nuclei by high-energy electrons is described. A 500-Mev electron beam from the Stanford Mark III Linear Electron Accelerator bombards

a lithium target and is then monitored by a secondary electron monitor. A magnetic spectrometer directs pions from the lithium target into a plastic scintillator, from which pulses are detected by a photomultiplier-amplifier system. The pulses are counted in coincidence with three gates delayed, respectively, 2.2, 4.4, and 13.2 microseconds after the accelerator beam pulse. Thus the pions are counted and identified through the positrons resulting from the $\pi^+ \rightarrow \mu^+ \rightarrow .e^+$ decay sequence.

Instead of obtaining an absolute cross section for the electroproduction of pions, this experiment measures electroproduction relative to photoproduction by electron-generated bremsstrahlung. Two yields are compared: that obtained when the target alone is in the path of the beam and that obtained when a slab of copper, the radiator, precedes the target in the beam path. The experimentally obtained ratio of these two yields compares reasonably well with that predicted for a hydrogen target under the assumption of a purely electromagnetic mechanism for the electroproduction process. The effect of the initial momenta of the protons in the lithium nuclei is estimated.

Data is obtained for pions having kinetic energies of 60 and 150 Mev, emerging from the target at a laboratory angle of 75 degrees with respect to the primary electron beam.

136 pages. $1.80. Mic 57-273

DIRECTIONAL AND POLARIZATION CORRELATION STUDIES OF IRON-56 AND LEAD-208

(Publication No. 17,204)

Galen Theodore Wood, Ph.D.
Washington University, 1956

Chairman: T. A. Pond

This work involves a study of the spins and parities of the energy levels of Fe^{56} and Pb^{208}. The determinations are based on polarization and directional correlation measurements on gamma-gamma cascades in Fe^{56} and Pb^{208} following the decay of Co^{56} and ThB, respectively.

The measurements were performed on a scintillation counter apparatus using Compton scattering as the polarization sensitive process. The counters were followed by a fast-slow coincidence system operating at resolving times of less than 10^{-8} seconds and provided with differential pulse height selection on each channel to make possible energy resolution in both polarization and direction sensitive detectors. An additional counter was provided in both directional and polarization correlation experiments in order to allow the simultaneous comparison of coincidence counting rates at two orientations of the counters.

Experiments on the levels of Fe^{56} were limited to the 0.845--1.238 Mev γ--γ cascade and involved measurements of the polarization 0.845--direction 1.238 and polarization 1.238--direction 0.845 Mev correlations. These measurements when combined with the directional correlation studies of previous workers lead to a unique assignment of spins and parities 0^+, 2^+ and 4^+ to the 0, 0.845 and 2.083 Mev levels in Fe^{56}.

Experiments on the levels of Pb^{208} were more detailed and involved measurements of the single channel and coincidence gamma-ray spectra; directional correlation measurements between the 2.615--0.583 Mev, 0.583--0.511 Mev, and 2.615--0.860 Mev γ--γ cascades; and polarization correlation measurements of polarization 2.615--direction 0.583 + 0.511 + 0.860, polarization 0.583 + 0.511--direction 2.615, polarization 0.511--direction 0.583 and polarization 0.860--direction 2.615 Mev. The results yield spin and parity assignments of 3^-, 5^-, 4^- and 5^-, respectively, to the 2.615, 3.198, 3.475 and 3.709 Mev levels in Pb^{208}, and multipolarity character assignments of E3, E2, M1 + E2 ($\delta = -0.18 \pm 0.03$), and M1 + E2 ($\delta = -0.025 \pm 0.009$), for the 2.615, 0.583, 0.511, and 0.860 Mev gamma-rays, where δ is the ratio of the reduced quadrupole to dipole nuclear matrix elements. With suitable adjustment of the multipolarity mixing ratios of the various gamma-rays in Pb^{208} other interpretations can be found consistent with the directional correlation measurements alone but can be rejected on the basis of the polarization correlation experiments.

Thus, the results indicate that polarization correlation can provide the additional information necessary for a unique interpretation of directional correlation experiments when the gamma-rays are possibly mixed in multipolarity. General theorems regarding this potentiality for removing mixture ambiguity are demonstrated from angular correlation theory for M1 + E2 transitions.

Finally, these results provide evidence for the internal conversion theory of Sliv and Listengarten which takes into account the finite size of the nucleus and yields for M1 transitions at Z = 82, K-conversion coefficients 66% of those calculated by Rose. The corrected theoretical K-conversion coefficients of the 0.511 and 0.860 Mev transitions computed on the basis of the mixing ratios determined above are in excellent agreement with measured values reported previously.

143 pages. $1.90. Mic 57-274

THE EFFECT OF HYPERTHYROIDISM ON THE CARDIAC WORK AND CARDIAC METABOLISM OF THE DOG

(Publication No. 19,642)

Dorothy Ann Piatnek, Ph.D.
University of Pittsburgh, 1956

An investigation of the manner and mechanism by which the administration of excess exogenous thyroid hormone affects the heart of the dog was designed with the following objectives in mind: (a) to describe the onset and course of hyperthyroidism induced in the dog since it is seldom used in experimental hyperthyroidism and to explore the relationship of the salivary gland in inactivation of the thyroid hormone, (b) to determine the effect on the work and metabolism of the heart, and (c) to ascertain whether or not preexistent heart disease is necessary in the development of thyrocardiac condition.

Exogenous hyperthyroidism was induced in 18 dogs by the oral feeding of 500-1000 mgm./kg./day of U.S.P. desiccated thyroid powder or by subcutaneous injection of 0.6-1.2 mgm./kg./day of 1-thyroxine. Clinical criteria supplemented by laboratory measurements were used to describe the onset and course of thyrotoxicosis. Before and after thyroid administration measurements of heart work and myocardial metabolism were obtained by the technique of coronary sinus catheterization.

It was found that the dog was extremely tolerant to large amounts of exogenous thyroid hormone. Doses 200 times human doses were required to induce hyperthyroidism in dogs. These doses were tolerated for as long as 10 months with few fatalities. A classic picture of clinical thyrotoxicosis as seen in human subjects was evoked in dogs, substantiated by laboratory findings of elevated levels of protein-bound iodide (PBI), increased turnover rates of PBI, and an apparent polycythemia. No creatinuria nor hypocholestermia were found.

An alteration of cardiac performance by excess thyroid hormone was suggested by the observed increased stroke work efficiency in 13 out of 18 dogs, probably a result of the high venous return. Cardiac failure, however, was induced in five dogs three of which has no pre-existent heart lesions. Elevated right end diastolic filling pressures, marked decreases in stroke efficiency, and/or histopathological signs of chronic passive congestion in the lungs and liver indicated failure.

Metabolic studies indicated that in hyperthyroidism the heart may rely less on carbohydrate and more on fat for energy production. Decreased extractions of pyruvate and lactate were observed with a slightly decreased glucose extraction and a respiratory quotient. Analyses of the myocardia of thyroid treated animals revealed normal to increased levels of adenosinetriphosphate, phosphocreatine, and inorganic phosphorous, even in the hearts that exhibited failure. This finding conflicts with existing views of the role of excess thyroid hormone as an uncoupling agent of oxidative phosphorylation.

A role of the salivary glands in the catabolism of the thyroid hormone was suggested. Decreased turnover rates of protein-bound iodide and decreased urinary excretion of thyroxine metabolites were observed following the injection of radioactive 1-thyroxine to euthyroid and hyperthyroid salivariectomized dogs.

123 pages. $1.65. Mic 57-275

THE OCCURRENCE OF PULMONARY EDEMA DURING THE AGONAL PERIOD OF SUDDEN ASPHYXIAL DEATH AND OBSERVATIONS ON THE NATURE OF ITS DEVELOPMENT

(Publication No. 17,821)

Henry Edgar Swann, Jr., Ph.D.
University of Maryland, 1956

Supervisors: Dr. Sidney Grollman and
Dr. Norman E. Phillips

Microscopic studies were made on the lungs of seventy human cases of sudden death. The deaths were due to drowning, cardiac failure, strangulation, brain injury, electrocution, carbon monoxide poisoning, natural gas asphyxia, freon vapor asphyxia, suffocation, barbiturate narcosis, and the ingestion of phosphorus, phenol, paraldehyde, or mercuric chloride. The post mortem interval between cessation of heart action and autopsy where known was from four to twenty-four hours.

The results from the human cases indicate that acute pulmonary edema occurs in a variety of asphyxial conditions where death is sudden. The edema does not always appear as presented by the classical pathological description of a smooth homogeneous coagulum. The lung edema in these acute deaths appeared stringy or granular as well as smooth. The edema had a patchy distribution throughout the lungs. In the drowning cases it was not accompanied by congestion or hemorrhage. Changes that accompany edema included alveolar phagocytes in nearly all cases and congestion in the strangulation and the cardiac cases, and hemorrhage in the brain injury cases.

The time of onset of lung edema could not be estimated from the human cases. Thus, experimental investigations with laboratory animals were made in which the autopsy was performed in a matter of minutes. Five dogs, fifty-eight guinea pigs and seventy rats were used in this part. The dogs were drowned, whereas, in the rats and guinea pigs breathing was stopped by brain injury, strangulation, nembutal, nitrogen, carbon monoxide, ether asphyxia and exsanguination as well as drowning.

The edema developed in the animal lungs between cessation of breathing and cessation of heart action. This period is known as the agonal period. The edema and accompanying conditions appeared similar to human cases where breathing was stopped by similar methods.

Drowning appeared to be the best method of consistently producing edema without other complications and was used

in experiments to demonstrate the possible nature of pulmonary edema developed. Sixty-five rats were used in this group of experiments.

Rats were drowned in water containing dye or particles in order to demonstrate the distribution and location of edema in the lungs. The inhaled water was distributed in a patchy fashion similar to the distribution of the edema. The inhaled water reached the alveoli and edema may occur where water has contacted the alveolar-capillary membrane.

India ink particles were injected into the right ventricle of drowned rats in an attempt to locate the source of edema. Particles were present in the edema and alveolar phagocytes of some rats indicating that plasma proteins may pass through the altered membrane into the alveoli.

Rats were drowned and autopsy performed at definite intervals after cessation of breathing. Analysis of the results by the probit method indicates that the time of edema development during the agonal period falls between 2.7 and 5.0 minutes after cessation of breathing with an expected development in fifty percent of the rats at 3.4 minutes.

All asphyxiated animals may not develop edema during the agonal period but in those in which it occurs the process may be rapid and become a factor for consideration in artificial respiration procedures.

105 pages. $1.50. Mic 57-276

A STUDY OF THE INTERACTION OF MACROMOLECULES WITH ERYTHROCYTES

(Publication No. 19,936)

Ignatius Louis Trapani, Ph.D.
Stanford University, 1956

An investigation was made on the physico-chemical properties of certain polymer materials: glycerol pectate and oxypolygelatin. It was found that glycerol pectate is degraded by periods of storage, either in aqueous solution or in the lyophilized state. The number-average molecular weight of the unstored material is 61,619; it is reduced to 23,237 and 22,311 after 14 weeks and 9 months storage, respectively. The number-average molecular weight of the lyophilized material is reduced to 22,203 after 9 months storage. The heat of degradation for glycerol pectate stored at various temperatures is 2911 calories. Calculations of the size of glycerol pectate residues, based on viscosity and molecular weight determinations of samples stored at various temperatures, showed that the glycerol pectate molecule is "stiffer" than that of a Gaussian coil. The dimensions of the unstored material were found to be: 1290 A^0 for the fully extended length; 80.3 A^0 for a Gaussian coil; and 248 A^0 for $(\bar{r}_0^2)^{\frac{1}{2}}$.

The process of interaction of erythrocytes with macromolecules was evaluated by studies of papain digested cells. The course of the changes accruing to the cell was followed by the method of complement fixation, specific agglutination, and the non-specific interaction (suspension stability) with gelatin and glycerol pectate.

It was concluded that the interaction of erythrocytes with macromolecules occurs by means of H bonds. The effect of papain digestion is to increase the degree of H bond formation between the cells and the polymer due to unfolding of the protein moieties of the cell surface ultrastructure.

215 pages. $2.80. Mic 57-277

POLITICAL SCIENCE, GENERAL

CONTROL BY CONGRESS OVER THE SEATING AND DISCIPLINING OF MEMBERS

(Publication No. 19,691)

John Thomas Dempsey, Ph.D.
University of Michigan, 1956

This study is an attempt to investigate, analyze and describe the nature and extent of the powers over membership possessed by the Congress of the United States. Four different, though closely related powers of Congress are considered: (1) to decide election contests; (2) to judge the qualifications of members and members-elect; (3) to censure and condemn members; (4) to expel members. The significance of these powers arises from their relationship to the representative character of Congress, which is a national institution concerned in part with national affairs, yet composed of representatives of particular constituencies. Careless or malicious exercise of these powers can frustrate the will of the particular constituency; however, failure to invoke them when needed, or their utilization in a partisan manner, can jeopardize the stability and effectiveness of the entire Congress.

The first two chapters of the study discuss the importance of these powers in a system of representative government, and trace their origin and development, first in England, and then in Colonial America. The proceedings of the Constitutional Convention of 1787 are discussed, in an effort to ascertain the intentions of that Convention concerning the nature and extent of these powers. The next five chapters examine each of these powers in detail, reviewing the pronouncements of judicial authorities and scholars concerning these powers, and describing the procedures which the two Houses have employed in exercising them. All instances of their application from 1789 to 1955 are classified and summarized, and general principles which have emerged from their use are presented. Weaknesses and dangers which have been disclosed by the utilization of these controls are explained, with special attention devoted to the effects of partisanship, where ascertainable. Specific suggestions as to how the employment of these powers might be improved are advanced and the advantages and disadvantages of such possible improvements are assayed. The prospects for improvement are discussed as well. Because of its relationship to the powers under consideration, the subject of a Congressional recall is accorded particular attention. The conclusion is advanced that a recall of this nature is contrary to the intention of the framers of the Constitution, and would not be accepted by Congress.

Certain general conclusions can be drawn from this study: (1) the power to judge contested elections frequently has been employed for partisan purposes, primarily because of the failure of the Constitution to provide definite standards to guide its exercise; (2) the power to judge qualifications has been exercised cautiously, in most instances; (3) the power to discipline members usually has been exercised in a judicious manner, and partisanship, although frequently present in such cases, rarely has been determinative; (4) the answer to such abuses as may appear in the exercise of the powers under consideration is a greater popular awareness of the proceedings of Congress, coupled with the adoption of certain minimal procedural reforms, as suggested in this study.

386 pages. $4.95. Mic 57-278

A STUDY OF WILLIAM HENRY SEWARD, REFORMER

(Publication No. 19,972)

Wayne Reynolds Merrick, D.S.S.
Syracuse University, 1956

William Henry Seward, honors student, lawyer, militiaman, State Senator, Governor, United States Senator, strong candidate for the Presidency, and finally Secretary of State, began life in 1801 in a small New York State village. A fortunate combination of high intelligence, love of learning, favorable home environment, and his choices as close advisers, provided Seward with the bases on which he built an active and useful life.

The influences that predominated in shaping young Seward's live were his parents, his wife, President Nott of Union College, John Quincy Adams, and Thurlow Weed. After making an outstanding record at Union College he entered a law partnership in Auburn, New York, married the senior partner's daughter, Frances Miller, and began an active career in public affairs.

After the downfall of the National Republicans, Seward cast his lot with the anti-Masonic Party, which elected him to his first public office, the New York Senate. In this legislative chamber, Seward's liberal viewpoints on many social, economic, and political matters first came to public attention. A few years later, in 1838, the new Whig Party succeeded in elevating him to the first of two consecutive terms as Governor. In this role Seward's reformist beliefs and activities made him a highly controversial figure within as well as outside his Party.

Seward believed firmly in universal education and universal suffrage as prerequisites for a successful democracy. In speeches in his early adult life he had already espoused the right of the Irish, the immigrants, and the Catholics, to enjoy the civil, political, and educational rights possessed by the rest of the citizenry. In his annual messages while Governor, he pressed hard for fulfillment of these objectives. This involved him in a major controversy over the New York City school system. His support of the Irish-Catholic-immigrant, and his alliance with Bishop John Hughes of the Catholic diocese of New York, earned for him the enmity of the conservative Whigs, and laid the basis of the oft-repeated charge against him of political opportunism. An examination of the issue proves quite conclusively that principles, not opportunism, led him into a fight which he recognized would be, politically, a liability.

As Governor, Seward also became involved in a controversy with the Governor of Virginia over fugitive slaves. Although persistently a faithful Whig, Seward increasingly

drew closer to the moderate abolitionists' position. Opposed to slavery, but unwilling to sanction violent means to eradicate it, Seward turned down the Liberty Party's Presidential nomination, One of the major Parties only, he felt, could be the effective force against slavery. He hoped the Whig Party would essay this role.

By late 1849, at which time he was elected to the United States Senate, Seward was already widely known for his anti-slavery views. His first year's record in the Senate made his name anathema to most Southerners and to many Northern conservatives and some ardent abolitionists alike. The reactions to his "Higher Law" speech seemed, even to him, to mark the nadir of his political fortunes. As his first session in Congress ended, Seward was a national figure, acknowledged, but not supported, by most people as one of the chief antagonists to the further extension of slavery.

Other reform areas such as legal procedure, incorporation in New York State, the militia, prison administration and internal improvement occupied Seward's attention. However, among the reform measures with which Seward was associated, the two emphasized in this paper, namely, slavery and education, brought him the most publicity and are outstanding examples of his struggle with principle and progress. 395 pages. $5.05. Mic 57-279

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

RECENT DEVELOPMENTS IN THE LAW AND PRACTICE OF THE UNITED STATES RESPECTING THE NEGOTIATION AND CONCLUSION OF INTERNATIONAL AGREEMENTS AND COMMENTARY ON PROPOSED CHANGES

(Publication No. 19,712)

Randall Hylman Nelson, Ph.D.
University of Michigan, 1956

The problem undertaken was a study of the law and practice of the United States with respect to the negotiation and conclusion of international agreements with major emphasis on the period since 1940 and an analysis of the proposed amendments to the Constitution with respect to the treaty and agreement-making power. Emphasis has been placed upon the comparison of treaties and executive agreements in the matter of use, the procedural aspects of negotiation and conclusion, and legal status under national and international law.

The method employed in the solution of the problem was first to survey the law and practice prior to 1940 through an examination of the leading commentaries and case law. A study was then made of the significant developments since 1940 with emphasis upon original source materials. Principal reliance was placed upon the relevant provisions of international agreements, debates in the Congressional Record, hearings before the committees of Congress, reports by committees of Congress, official publications of the Department of State, judicial opinions rendered in the state and national courts, provisions of statutes designed either to implement treaties, or to authorize or approve executive agreements, and, finally, the writings of learned commentators.

There have been two general attempts to amend the Constitution relative to the making of treaties and executive agreements. The first attempt was to make the House of Representatives an equal partner with the Senate in the treaty-making process and to eliminate the two-thirds rule. The second attempt was to limit the treaty-making power of the national government and to restrict the power of the President to conclude executive agreements.

The need for a smoothly functioning procedure for executing foreign policy had resulted in a considerable reconciliation of conflicting powers in the field of foreign affairs through consultation between the executive and legislative branches of the government.

There is a divergence of opinion as to the circumstances and subjects which require international agreements to be concluded as treaties or as executive agreements and as to the relative force to be accorded treaties and executive agreements under international and municipal law.

The conclusions drawn from this study are: (1) Executive agreements and treaties may be used interchangeably with respect to a broad category of subjects. The present law and practice however does not permit complete interchangeability in the use of the two types of instrument. (2) Treaties and executive agreements are equally binding under international law. In municipal law, the precise force and effect to be accorded executive agreements has not been as clearly established as the law relating to treaties. Recent court decisions indicate that there may be important differences in the force to be accorded to a treaty and the force to be accorded an executive agreement, particularly an executive agreement made by the President without statutory authority.

(3) In the recent period, a large volume of executive agreements have been concluded pursuant to the combined powers of the President and the Congress. There is no evidence of the abandonment of the traditional use of treaties. (4) There has been an increased participation by both the Senate and the House of Representatives in the making of international agreements. (5) No proposed amendment has been able to win the support necessary for passage in the Congress, and future changes in the law and practice of the United States relative to the negotiation and conclusion of international agreements are likely to come about through custom and usage rather than by constitutional amendment. 522 pages. $6.65. Mic 57-280

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

THE PREMIUM GOLD CONTROVERSY IN THE INTERNATIONAL MONETARY FUND

(Publication No. 19,240)

Theodore Geiger, Ph.D.
Columbia University, 1956

Please see Economics, history for abstract.

220 pages. $2.85. Mic 57-94

PSYCHOLOGY, GENERAL

SOME FACTORS INFLUENCING REMEMBERING OF PICTORIAL AND PROSE MATERIALS

(Publication No. 19,488)

Russel Grant Drumright, Ph.D.
The University of Oklahoma, 1956

Major Professor: Henry Angelino

Two experiments, suggested by Bartlett's work, were conducted in order to determine the influence of the factors of time, age, attitude, frequency of testing, and social norms upon the perception and remembering of photographs and meaningful prose material.

The same persons – 53 University of Oklahoma undergraduates and 53 seventh grade pupils – were subjects for both experiments. Each set of 53 subjects was divided into successive-reproduction and single-reproduction groups, matched on the basis of Bogardus Ethnic Distance scores.

Five labeled photographs of men of different ethnic groups (Negro, Jew, Mexican, Chinese, and White American) were used as the stimulus material for Experiment I. An effort was made to select men of apparent equality in socio-economic level, who differed from the racial stereotype. Perception and recollection were tested with a test-sheet and a check list. Rank-order non-parametric statistical procedures were used to test the significance of difference in results. In Experiment II, the same groups read and reproduced an Indian legend, "The War of the Ghosts."

The results of these experiments lead to the following conclusions:

1. Racial attitude is related to the perception of skin color and to the evaluation of the "kindness" of a pictured man. The direction a pictured man is facing is remembered best by those who are favorable toward his race. When a subject's attitude toward a picture conflicts with a racial attitude, there is a strong tendency to change the memory of the former toward agreement with the latter.

2. A tendency to change toward the racial stereotype is evident, especially with the Negro.

3. Deviations in details during an eight weeks period follow three deviation patterns, which can be described as stereotyped, circular, and delayed-stereotyped. Continuous deviations are almost non-existent. Patterns support the frame-of-reference theory of remembering rather than the Gestalt theory.

4. Subjects who are tested repeatedly retain pictorial and prose material more accurately than subjects tested a single time.

5. Children are less influenced by racial stereotypes than adults, both in perception and remembering. Their attitudinal frames of reference appear to be more fluid. On the type of materials used in this study, adults excel only in remembering names of pictures in a sequence.

6. Memory of the order of sequence of a series follows the well-established laws concerning the remembering of members of any series. Serial position, essentially to the whole, and emotional tone determine whether an idea will be retained accurately.

7. Conventionalization and simplification occur in the remembering of prose material, whether subjects are adults or children, with both single and repeated testing. Assimilation is a characteristic of children's reproductions. Importations are common, serving as a frame to bind details together and make them consistent.

151 pages. $2.00. Mic 57-281

AN EXAMINATION OF THE UNSAFE ACT AS A PREDICTOR OF ACCIDENT RATES

(Publication No. 17,799)

Homer Rudolph Figler, Ph.D.
University of Maryland, 1956

Supervisor: Professor Ray C. Hackman

This study examined the relationship between unsafe acts and accident rates. Without their knowledge, 100 taxicab drivers were observed by the investigator as they transported him in the normal operation of their vehicles. During the ride, the observer made judgments about each driver's behavior, using as a guide a list of unsafe acts that had been derived from a survey of taxicab company officers and safety engineers.

In addition to observing each driver, the investigator engaged the driver in a seemingly normal conversation from which inferences were made about the driver's attitudes toward his job, safety, and the company for which he worked. Traffic violations, other than those contained in the list of unsafe acts, and near accidents that occurred, were also recorded. Following the check ride, each driver was administered a test of intelligence and a personality test. Biographical information and accident records for each driver were obtained from the company files. For 71 of the 100 rides, the observer made an estimate of his own feelings of comfort during the ride.

The results indicated that accident rates were significantly related only to driving experience, in that the drivers with high accident rates were those with considerable experience as cab drivers. On the other hand, unsafe acts were related significantly to attitude toward safety and to estimates of comfort. A total attitude score, composed of the three separate attitude scores combined, was significantly related to total driving experience and to the estimate of comfort. Intra-observer and inter-observer reliability estimates were acceptably high.

Three major conclusions are drawn from the results of this study. First, it is concluded that the unsafe act should be seriously examined as an alternative criterion in accident research. Unsafe acts can be readily observed and

the measures derived from the observations are reliable. Second, attitude measures show promise as predictors of unsafe acts. Attitudes, as such, have not been studied sufficiently in the past. They are related to unsafe acts and thus, should predict unsafe behavior before such behavior results in an accident. Third, feelings of personal comfort in a passenger are determined in part by a cab driver's pattern of driving behavior. This relationship is of particular importance to any taxicab company that depends upon passenger goodwill for financial success.

78 pages. $1.50. Mic 57-282

FACTORS RELATED TO CHILDREN'S CLOTHING PREFERENCES

(Publication No. 18,855)

Lucille Aust Hunt, Ph.D.
Purdue University, 1956

Major Professor: E. J. Asher

The purpose of this investigation was to determine what relationships exist among certain factors generally assumed to influence children's clothing preferences. The stimulus variables were color (including hue, brightness, and saturation), pattern, style (in relation to occasion), and texture. Color preferences were investigated by presenting six hues (red, orange, yellow, green, blue, and violet) at maximum saturation. Brightness preferences were investigated by presenting each of the six hues together with a lighter and a darker brightness level. Saturation preferences were investigated by presenting each of the six hues together with an unsaturated level. Pattern preferences were investigated by presenting a solid color, a stripe, a check, and a geometric design in the best linked color and, again, in the least liked color. Style preferences were investigated by presenting six styles ranging from play clothes to party clothes in relation to three occasions, namely school, home, and a party. Texture preferences were investigated by presenting five textures ranging from smooth to rough; namely, fur, satin, cotton broadcloth, corduroy, and casement cloth. To investigate other aspects of children's clothing likes and dislikes, two open-end questions were included.

One hundred and twenty-eight children, ranging in age from three through ten and living in an upper-middle class surburban area, were interviewed. Each child was asked to indicate his preferences among each group of stimulus variables and to describe his best liked and his least liked clothes. In order to investigate the extent of mother-child agreement, the mother of each child was interviewed regarding her preferences for her child. Age and sex differences were investigated as well as relationships among certain of the stimulus variables.

The results of this investigation suggest that, under these conditions, certain tendencies exist among the factors related to these children's clothing preferences. These tendencies may be summarized as follows:

1. Significant differences in preferences appeared to exist among each of the six stimulus variables.
2. Brightness and saturation preferences tended to vary significantly with color.
3. Pattern preferences tended to vary significantly with color preferences.
4. Style preferences tended to vary significantly with occasion.
5. Age appeared to influence color, pattern, style, and texture preferences but not brightness or saturation preferences.
6. Sex appeared to influence brightness, pattern, and style preferences but not color, saturation, or texture preferences.
7. Mother-child agreement appeared to increase with advancing age although the magnitude of the differences was significant only in the cases of style preferences and texture preferences.
8. Sex appeared to influence mother-child agreement on brightness and style preferences but not on color, saturation, pattern, or texture preferences.

These results indicate that certain factors are closely related to children's clothing preferences and that these factors are worthy of further investigation.

110 pages. $1.50. Mic 57-283

THE ACHIEVEMENT MOTIVE AND LEVEL OF ASPIRATION AFTER EXPERIMENTALLY INDUCED SUCCESS AND FAILURE

(Publication No. 18,639)

Barbara Spensley Cook Pottharst, Ph.D.
University of Michigan, 1956

The purpose of this study is to relate differences in strength of achievement motive to differences in performance goals that persons set for themselves (level of aspiration) on two tasks in a test situation, before and after being told they have succeeded or failed.

The research is guided by hypotheses derived from a proposed theory of motivation formulated by McClelland and his associates and from previous research on level of aspiration.

Subjects are 43 male college students. They are divided into three groups according to strength of achievement motive as measured by an analysis of imaginative stories which they have produced. Differences in strength of achievement motive are related to differences in:

(1) Stated level of aspiration for a digit symbol task in the test situation following two practice trials and also after success or failure.

(2) Stated level of aspiration for an unpracticed new task (maze-tracing) following success or failure on the digit symbol task.

(3) Performance on the digit symbol task (a) in a relaxed practice situation; (b) in the test situation; (c) following success or failure in the test situation.

In the test situation half of the subjects are given exaggerated positive reports and half exaggerated negative reports concerning the extent to which they have reached their stated goals on the digit symbol task in order to induce feelings of success or failure.

The results do not show any relationship between strength of achievement motive and level of aspiration on the original digit symbol task in the test situation. Following success on the digit symbol task, all subjects,

irrespective of motive strength, increase their level of aspiration. Following failure, only subjects in the group who are moderate (middle third) in strength of achievement motive decrease their levels of aspiration. However, following both success and failure, strongly motivated subjects set significantly higher levels of aspiration for the unpracticed maze-tracing task than less strongly motivated subjects. Also, the strongly motivated group sets a significantly higher level of aspiration for the new task following success than following failure.

The results concerning performance show that subjects strong in motivation to achieve, obtain significantly higher performance scores than less motivated subjects in the test situation. In response to failure, subjects low in achievement motivation improve in performance significantly more than those more highly motivated. On the other hand, in response to success, the highly motivated group tends to improve in performance more than the less motivated subjects.

Results lend support to previous studies showing a positive relationship between achievement motivation and performance in a test situation. Further, the results also suggest that level of aspiration is related to motivation intensity only when cues from the level of past performance are ambiguous, but not when these cues are unambiguous and may give rise to probability judgments concerning performance. Differences in results for subjects of strong and weak achievement motivation suggest that strongly motivated subjects improve most with success. Those with weak achievement motivation improve most with failure probably because of motivations other than achievement, such as need for social approval or acceptance.

81 pages. $1.50. Mic 57-284

AN INVESTIGATION OF TURNOVER AS A DECISION-MAKING PROCESS

(Publication No. 17,823)

Willard S. Vaughan, Jr., Ph.D.
University of Maryland, 1956

Supervisor: Professor Ray C. Hackman

This study was designed to explore the parameters of workers' job decisions. The framework within which this problem was investigated was provided by the statistical decision-making model which specified values, probabilities of occurrence, and decision criteria as the three parameters of an individual's choice among alternative actions.

A set of interview questions was designed, focusing first upon the worker's original decision to make the job and secondly upon his most recent job decision which he resolved by either quitting or staying with the company. The questions were open-ended and directed specifically toward eliciting verbal responses relative to each of the three parameters specified by the statistical decision model. This preliminary interview form was pretested by interviewing thirty workers seeking jobs through the United States Employment Service of Washington, D. C. The questions were revised during the pretesting and eventually used to interview a sample of workers consisting of eighteen presently employed by a Washington utility company, and twenty-four who had voluntarily resigned from that company.

The interview described each worker by a set of background characteristics as well as by his verbal responses and numerical ratings regarding the nature and importance of the determinants of his job decision. One question required that eight typical job values be rated in terms of their relative importance as characteristics of a "good" job, so that each worker was described by a profile of eight ratings. The D measure of profile similarity which accounted for both profile covariation and absolute score differences was computed for all pairs of workers, and a cluster analysis of the resulting matrix yielded four distinct groups. Each group was homogeneous as the mean D among the members of each group was less than one standard deviation below the mean of the D distribution. The groups were independent to the extent that the mean D between the members of the different groups was, to various degrees, greater than this value. The reliability of the cluster analysis technique was evidenced as only two cases were incorrectly assigned in the second cluster analysis from a randomly recoded D matrix.

These four worker groups were described in terms of their members' characteristic response to the remainder of the interview. Systematic differences were found among the groups' reports of their job values, expectations of fulfilling these values, and decision criteria. Group I emphasized social values, held pessimistic expectations of fulfilling achievement related values and never had had occasion to consider quitting. Group II stressed security and achievement values but were pessimistic about their achievement possibilities. They considered quitting but reluctance to risk the security of their present job influenced them to stay. Achievement values were the dominant influence to the members of Group III and they held optimistic expectations of fulfilling them. They appeared to employ a maximum gain type of criterion to their job decision which resulted in their leaving the Company. Group IV was influenced by the nature of the work as well as advancement and the members held optimistic expectations of achieving these values. They resolved their job decision by a maximum gain criterion tempered by their interest in a specific field.

These descriptions of the groups' characteristic decision processes were interpreted as reflecting different levels of occupational achievement motivation.

108 pages. $1.50. Mic 57-285

PSYCHOLOGY, CLINICAL

MORAL STANDARDS AND DEFENSES AGAINST GUILT

(Publication No. 19,676)

Justin Manuel Aronfreed, Ph.D.
University of Michigan, 1956

Chairman: D. R. Miller

In the first part of the dissertation, the following theoretical principles and their implications are discussed: People react in different degrees and in different ways to

the guilt that results from violations of their internalized moral standards about aggression. The severity of a moral standard – the amount of guilt or self-punishment which a person experiences when he behaves unacceptably – is thought to be proportional to the degree of punishment which his parents previously employed in controlling the expression of his needs. Some people are forced to avoid recognizing their moral standards because they are made too uncomfortable by the intensity and frequency with which they punish themselves. Individuals who have available few acceptable ways of expressing their needs are likely to have their needs become so strong that they can no longer control them.

This study is concerned with the relationship between conditions antecedent to guilt reactions and masculinity-femininity. The predictive rationale of the study is that when parents punish a boy intensely for the active expression of his needs, he is apt to learn passive-feminine modes of behavior which include severe prohibitions on aggression. Two measures of masculinity-femininity were used to define three groups of men: Those who received typical masculine scores on both a drawing test of self-expression and a test of verbally reported attitudes, those who received feminine scores on both, and those who received feminine scores on the first test but very high masculine scores on the second. It is assumed that the drawing test taps aspects of masculinity-femininity of which a person is less aware than he is of the attitudes and interests common to men and women, and that the last group of men described above find it necessary to deny their underlying passivity.

Moral behavior was assessed by coding the completions of unfinished stories, each containing a guilt situation. Two sets of stories were used, one before and one after a situation in which the subject apparently broke a delicate machine. The subjects were 107 single while college men, born in the United States. They must have had both parents present during at least four of the first six years of life.

A number of inferences were made about variations among the three masculine-feminine groups in the child-rearing practices of their parents, and about how these would result in different reactions to moral standards. To test these inferences, subjects were asked on a questionnaire to report on certain parental activities and decisions which might indicate an unusual dominance by one parent. Finally, data was gathered on the family's social positions. It was felt that masculinity or femininity would be related to the values and standards which accompany certain forms of social organization that vary with respect to the degree to which economic roles are dependent upon one another.

The results of the study show that under conditions of the arousal of guilt, basically feminine men have the more severe standards. They tend to defend against their feelings of guilt, while the masculine group show more recognition and acceptance of theirs. The feminine groups gave more frequent evidence of loss of control over the expression of their needs. There is no clear-cut support for the assertion that masculinity or femininity is related to specific patterns of parental dominance. However, the results provide encouragement for refining the conception and measurement of family relationships. The importance of child-rearing practices is indicated by a relationship between masculinity or femininity and the different forms of social organization in which families participate.

The following conclusions seem appropriate: Men who early in life have learned to express their needs passively tend also to have internalized severe moral standards about aggression, and to defend against their guilt. These moral phenomena are related to the societal roles of the family group. 216 pages. $2.80. Mic 57-286

THE LEARNING OF TWO MECHANISMS OF DEFENSE

(Publication No. 19,680)

Betty Alden James Beardslee, Ph.D.
University of Michigan, 1956

This study was concerned with the ways that children who are raised in different social class backgrounds and by different methods of child-rearing learn to defend themselves against conflict. The subjects were 112 junior high school boys from the Detroit Public School System. Information about parental demands for obedience, frequency of reward, and type of discipline was obtained in interviews with their mothers. These interviews also supplied information about occupation and education of the fathers. This information was the basis for assigning the subjects to either the middle or lower social class. The controls used in selecting the subjects included the factors of age, sex, race, intelligence, racial and religious background, broken homes, and southern geographic origin of the family.

The study focused on the relationships between the backgrounds of the subjects and defenses against two types of conflict. One experiment investigated denial in fantasy as a defense against a conflict between fear of failure and ambition. Subjects wrote endings to incomplete stories before and after they were exposed to a situation designed to arouse feelings of failure. Subjects increasing the number of unrealistic and wishful story endings after failure were compared with subjects decreasing such endings. Escaping to fantasy is, as was predicted, significantly related to harsh child-rearing methods such as parental demands for strict obedience and both pure psychological and pure physical punishment. Decreasing unrealistic fantasy after failure is associated with reasonable obedience and with mixed discipline. Social class background is not related to the defense of denial in fantasy.

Frequency of reward is not significantly associated with defense except when analyzed in combination with the variables of obedience and discipline. High frequency of reward combined with reasonable obedience produces decreasing unrealistic fantasy after failure; strict demands for obedience and infrequent reward are related to increasing unrealistic fantasy. When the child is controlled by psychological manipulation but is frequently rewarded, he tends to decrease unrealistic fantasy after the arousal. When psychological manipulation is combined with low frequency of reward, the child increases unrealistic fantasy.

These results were interpreted as supporting the hypothesis that harsh environmental conditions make it difficult for the child to find pleasurable outlets for his needs in reality and reinforce his tendency to escape into fantasy where he can deny painful realities.

Verbal intelligence is also significantly related to the use

of denial. Subjects with low verbal intelligence increase denial in fantasy after failure, while subjects with high verbal intelligence decrease it. Apparently, people above a certain level of intelligence cannot use so primitive a defense.

The second experiment investigated defenses against a conflict between anger and guilt. The subjects' anger was aroused in an experimental situation. Story endings written after arousal were compared with those written before the arousal. Increases in defensive distortions of aggressive needs after arousal are significantly related to the subjects' social class membership. There are no significant relationships found between the defenses and the single child-rearing variables. However, social class and obedience interact to produce significant results. Maximal defensiveness is a product of middle class background and strict demands for obedience. Demands for obedience and frequency of reward also interact to produce significant results. Minimal defensiveness is associated with reasonable demands for obedience and low frequency of reward. The fact that the interactions and not the single variables produce significant results is interpreted to indicate that it is not the specific parental practices but their meaning in the total context of all other practices that affects the defenses of the offspring.

226 pages. $2.95. Mic 57-287

THE ROLE OF HOSTILITY AND DEPENDENCY CONFLICTS IN PEPTIC ULCER ETIOLOGY

(Publication No. 18,755)

Charles Rothstein, Ph.D.
The University of Buffalo, 1957

The present study was designed to test the various psychological theories of peptic ulcer etiology. Specificity, general conflict, and general psychosomatic theories were reviewed. Predictions logically derived from these theories were postulated and tested. Most psychological theories of peptic ulcer etiology maintain that conflicts over dependency and/or hostility are the psychological precursors of peptic ulcer. Rorschach content, scored according to De Vos' system, was used as the measure of conflict in these two areas. A peptic ulcer group was compared with a normal, a psychoneurotic, a schizophrenic, and a general psychosomatic group (without gastro-intestinal symptoms), to determine whether measures of conflict in the areas of dependency and/or hostility would significantly differentiate them from the other experimental samples. The assumption was made that if differences were obtained among the various samples on measures of hostile and dependent conflicts, it would help clarify the theoretical assumptions regarding the role of these psychological conflicts in peptic ulcer etiology.

The peptic ulcer group scored significantly higher on measures of conflict in the areas of hostility and dependency than did the normal and psychoneurotic groups. They did not, however, score significantly higher on these measures than did the schizophrenic or non-gastro-intestinal psychosomatic groups. These results were discussed in relation to the predictions logically derived from the various psychological theories of peptic ulcer etiology.

It appears that specificity theories are not supported by the results of this research. General conflict and general psychosomatic theories appear to be partially supported by these results.

A theoretical position, derived, in part, from some of the previous speculations, and, in part, from this writer's own theoretical orientation, was presented. This position states that a dynamic relationship exists between dependency needs, frustrated dependency needs, aggressive feelings, and suppression of aggression. Conflicts over dependency and hostility, resulting from these interrelationships, were presumed to be present in the peptic ulcer, schizophrenic, and general psychosomatic groups to a greater extent than in the normal and psychoneurotic groups. Conflict was presumed to be the consequence of the lack of defenses adequate to deal with dependency needs and hostile feelings. The somatic site of involvement does not seem to be pre-disposed by the nature of the conflict. Another factor, such as constitutional weakness, appears to be necessary to explain the somatic symptoms following psychological conflicts. 103 pages. $1.50. Mic 57-288

A COMPARISON OF DELUSIONAL AND HALLUCINATORY INDIVIDUALS USING FIELD DEPENDENCY AS A MEASURE

(Publication No. 18,875)

James N. Taylor, Ph.D.
Purdue University, 1956

Major Professor: John M. Hadley

A study was carried out at a Veterans Administration Hospital with groups of psychotics, using behavioral differences rather than diagnostic categories as criteria for group formation. Three groups, a delusional group, an hallucinatory group, and a group made up of non-delusional, non-hallucinatory subjects were tested with measures of field-dependency. The general hypothesis involved was that delusional subjects would be found to be more field-independent than hallucinatory subjects as measured on the tests used. This hypothesis was drawn from literature cited in the study.

The subjects were selected on the basis of independent ratings made on a modified Lorr Scale. The final experimental groups tested consisted of twenty-seven delusional subjects, twenty-six hallucinatory subjects, and twenty subjects not exhibiting either behavior. Three tasks related to field-dependency were employed. The first was a standard technique used in such studies, the second was of similar construction to the first and was developed by the author, and one was a measure of responsiveness to social field factors.

Twelve specific test-related predictions were educed from the general hypothesis. Of these, seven were confirmed by the results and three more varied in the predicted direction. The measure of responsiveness to social field factors was not found to be significantly discriminative, whereas the standard field-dependence technique, the Gottschaldt-Witkin Embedded Figures, was found to give the best discrimination between groups. The results were discussed and a speculative section concerned with

diagnostic and psychotherapeutic implications and research possibilities was appended.

69 pages. $1.50. Mic 57-289

DEVELOPMENT OF A SCORING SYSTEM FOR THE CHILDREN'S FORM OF THE BLACKY PICTURES

(Publication No. 19,728)

Louise Morrison Winter, Ph.D.
University of Michigan, 1956

The major objective of this research was to explore the possibility of developing an objective scoring system for research use of the Blacky Pictures. The study made use of two groups of school children in the third and fourth grades. The first group of 30 boys and girls was enrolled in the University of Michigan Elementary School in 1949 and was tested on the Blacky Pictures in connection with a research study at that time. The cross-validation sample of 40 children currently enrolled in the same school was tested by the present examiner under the same conditions as the first group.

The sources of criterion data were a number of diverse measures routinely collected on children in the school. These included intelligence and achievement tests, family and personal medical history, physical examinations and patterns of growth, teachers' ratings on behavior problems and social and educational development, teacher journals of peer interaction, and records of parent conferences.

From these sources criteria were selected which, according to psychoanalytic theory, represent behavior relevant to the Blacky dimensions. A number of stable, positively interrelated clusters of criterion measures were derived for most of the dimensions. Using these clusters, the Blacky protocols of the first group of children were then examined for indicators of disturbance. Where positive trends were found between the criterion clusters and Blacky themes or inquiry responses, cross-validation was done on the second group of subjects.

The themes or ideas in the spontaneous stories given in response to the cards proved to be the best differentiators of "high" and "low" conflict. The "all themes" category, which refers to a combination of differentiating themes on a given dimension, was found to be significantly related to disturbance on four of the cards (Oral Sadism, Oedipal Intensity, Identification Process, and Sibling Rivalry). On all the dimensions except one (Masturbation Guilt) some themes were shown to generate a positive relationship with the criteria in both groups. In addition, a number of inquiry items were cross-validated. These themes and inquiry items make up the core of a tentative scoring system. It was noted that many themes and inquiry responses, which appeared too infrequently for statistical evaluation in this study, may be shown in future research to be useful additions to the scoring system.

In conclusion, it appears that routine school measures of the type employed in this study can be used to derive behavioral criteria for research on psychoanalytic theory.

104 pages. $1.50. Mic 57-290

PSYCHOLOGY, EXPERIMENTAL

THE SMILING RESPONSE AND ITS RESISTANCE TO EXTINCTION AS A FUNCTION OF REINFORCEMENT SCHEDULE

(Publication No. 19,912)

Yvonne Wilcox Brackbill, Ph.D.
Stanford University, 1956

This investigation was primarily concerned with the instrumental conditioning of a social response (smiling) in infants. Ss were two groups of four infants each. The experimental variable was reinforcement schedule. One group was maintained on a conditioning schedule of intermittent reinforcement and the other on a schedule of regular reinforcement. The reinforcement consisted of social and body contact between E and S. The experimental hypothesis concerned relative resistance to extinction as a function of the differing reinforcement schedules. Results confirmed the expectation that intermittent reinforcement would be superior in maintaining continued performance of the smiling response during extinction. This result was supplemented by certain incidental data concerning the "protest" response and its relation to the smiling response.

81 pages. $1.50. Mic 57-291

AGE DIFFERENCES IN RETROACTIVE INHIBITION AS A FUNCTION OF THE DEGREE OF SIMILARITY OF MEANING BETWEEN THE ORIGINAL AND INTERPOLATED LEARNING

(Publication No. 19,624)

Michael Gladis, Ph.D.
University of Pittsburgh, 1956

The purpose of this study was to compare the amount of retroactive inhibition (RI) obtained in middle- and old-aged individuals with young adults as a function of varying the degree of similarity of meaning between the response items of the original and interpolated verbal learning lists while keeping the stimulus items of the paired associates constant.

Forty subjects from each of the following three age ranges: 20-29, 40-49, and 60-72 served as subjects. Ten subjects from each age group were assigned to one of four experimental conditions. Under all conditions, the subjects learned the same original list which consisted of eight paired associates with two consonants as the stimulus item and two syllable adjectives as the response item of the pair. In Condition I, the degree of similarity of meaning between the response members of the interpolated list and the original list was high, in Condition II moderate, in Condition III low, and in Condition IV neutral. The stimulus items remained constant from original to interpolated learning. The learning material was presented on a Hull-type memory drum with a four-second interitem interval and an eight-second intertrial interval.

An analysis of the data related to the learning and verbal ability of the subjects indicated that there were significant differences in the vocabulary level as measured by

the vocabulary subtest of the Wechsler Adult Intelligence Scale and the learning ability of the subjects as measured by the number of trials required to reach the criterion of mastery in original and interpolated learning between the three age groups. Vocabulary level was found to increase with age whereas learning ability tended to decrease with increasing age.

In order to adjust the obtained measures of RI, recall and savings scores, for the differences in learning and verbal ability between the age groups, the method of analysis of covariance was utilized. The multiple classification analyses of covariance performed yielded the following results:

1. RI, whether measured by the recall or savings method, decreased as the degree of similarity between the response items of original and interpolated learning increased.

2. No significant differences in RI were found to exist between the age groups after the recall and savings mean squares were adjusted for differences in verbal and learning ability, although significant differences were obtained in RI as measured by recall scores prior to the adjustment. An inspection of the trend of the various scores involved in the analysis of covariance indicated that the adjustment in recall scores for differences in learning ability was responsible for the change in the F value for between age groups to one that was no longer significant.

3. No significant differences were obtained between the interaction of age and degree of similarity of meaning for RI whether measured by the recall or savings methods.

The finding that RI increases with decreasing similarity of meaning between the response items of original and interpolated learning was interpreted as support for Osgood's formulation of the relationship between RI and degree of similarity in terms of stimulus and response elements. The fact that any significant differences between the age groups in RI could be accounted for in terms of differences in learning ability of the subjects seemed to suggest that the deficit that occurs with increasing age is of a general type which holds for the entire class of responses subsumed under the rubric of verbal learning and retention. Failure to obtain any significant interaction between age and degree of similarity in either IL or RI suggested that there was no differential decline with increasing age.

81 pages. $1.50. Mic 57-292

THE FORMATION OF ORGANIZED RESPONSE PATTERNS IN CHILDREN USING SIMULTANEOUS AND SUCCESSIVE PRESENTATION OF STIMULI

(Publication No. 19,628)

Ruth De Forest Goodman, Ph.D.
University of Pittsburgh, 1956

So little is known of how normal children learn. This dissertation was prepared in the hope that, through the analysis of a rather complex problem with a homogeneous group of subjects, more light might be thrown on the learning process, a matter for concern to developmental psychologists as well as to learning theorists.

Sixteen normal, average fourth-grade children – selected from school records, with the groups further refined by teachers' judgments – were given learning set training. Three methods were employed: (A) simultaneous presentation of the stimuli; (B) successive presentation of the stimuli; and (C) simultaneous presentation of the stimuli with successive responses indicated. The presentations for two trials constituted a "problem"; 272 (when necessary) such "problems," with different stimulus objects for each problem, were presented to the child individually. Problems were presented in a modification of the Wisconsin General Test Apparatus, which permits the presentation of learning problems with a minimum of interaction between subject and experimenter. It has been shown that quite young children, with the simultaneous procedure and a simpler problem, could form "learning sets," otherwise known as organized response patterns, so that almost perfect responding occurred on the first trial after the informative trial following a series of such "problems."

The hypotheses tested in this paradigm concerned: (a) the possibility of the development of interproblem improvement to a predetermined criterion of 90 per cent correct second-trial responses over three blocks of 16 problems each by means of successive presentation – laboratory learning sets had not been tested before with single presentation of the stimuli; (b) the relative efficacy of the three methods utilized; (c) whether learning sets could be formed with cue, response, and reward spatially separated, a condition of all three methods; and (d) the possibility that the organized response pattern ultimately achieved consisted of two or more stimulus-response patterns.

Analysis of the data indicated that organized response patterns could be formed with successive presentation of the stimuli. There was no difference in the speed with which the learning was brought to criterion by methods A and B, although C was significantly more difficult than A or B. Differences among the methods for the number of recognizable stimulus-response patterns were found, statistical analysis of group responses delineating only one pattern for Method A, two for Method B and possibly eight for Method C. Under the condition of separation of cue, response, and reward all five subjects reached criterion with Method A, five of the six with Method B, but with Method C none formed organized response patterns over 272 problems, although the group was still improving at the termination of training. The slower rate of learning with C was attributed to the greater number of stimulus-response patterns being formed.

Learning sets were formed by children with successive presentation of stimuli as well as with simultaneous; with cue, response, and reward separated, and with but two trials per problem. The organized response patterns formed by these methods proved to be composed of less-encompassing stimulus-response patterns. Within and between the methods difficulty of learning was related to the number of lesser patterns being learned.

68 pages. $1.50. Mic 57-293

AN ANALYSIS OF COUNSELOR SUB-ROLES

(Publication No. 18,797)

Abe Edward Hoffman, Ph.D.
The Ohio State University, 1956

The study under discussion is concerned with the dynamics of the interaction between counselor and client, that is, the social psychology of communication in the counseling interview. Recent research has indicated that the shifts or variations in counselor behavior as the interview progresses are due to the roles which counselors assume. The major purpose of the study is to obtain by objective analysis a thorough description of the characteristics of the nature and range of counselor sub-roles.

PROCEDURE

Interviews

A total of 165 interviews held with forty-six clients from counseling centers at five universities are included in the study. The twenty counselors were selected on the basis of counseling experience with two or more clients, in a total of four or more interviews.

Check List of Sub-roles

A check list of counselor sub-roles and a manual of instructions were developed which included: (1) descriptions of each sub-role, (2) instructions for locating transition points between counselor sub-roles, and (3) instructions for classifying sub-roles.

Judges

Judges with extensive counseling experience made all of the sub-role ratings in this study. The training of the judges involved reading and discussing the Manual of Instructions for Judges, making practice ratings on interviews not included in the final study, and discussing practice ratings to clear up any misunderstandings.

Transition Point

A point in the interview was designated as a transition point if at least two of the three judges agreed in selecting it as such. Two ratings were counted as agreeing if the counselor statements designated as transition points by the judges were no more than three counselor statements apart.

Counselor Sub-roles

The sub-roles played by the counselor in each sub-role unit were classified by judges; a separate check list for each sub-role unit was used.

CONCLUSIONS

The analysis of the data are divided into four sections: (A) Reliability, (B) Frequency, (C) Pattern Similarity, and (D) Range.

Reliability

1. Judges agree at a statistically significant level on the location of transition points between counselor sub-roles.
2. Judges agree at a statistically significant level in classifying the sub-roles played by counselors between transition points.

Frequency

1. Some sub-roles occur significantly more often than others; however, all the sub-roles except Rejecting were used frequently.
2. The use of counselor sub-roles is determined early in the conference series regardless of total length of interview series. Counselors have a tendency to stay within their sub-role repertoire, once it has been established, regardless of client or of changes in the nature of problem presented.
3. The sample of counselors in this study is statistically adequate to permit generalizations concerning the kinds and frequency of sub-roles used by counselors.

Pattern Similarity

1. Counselors utilize a similar pattern of sub-role units with different clients even though clients differ and the nature of the problems differs.
2. There is some similarity existing between counselors in their use of sub-role patterns.
3. Counselors within a school tend to use similar patterns of sub-roles.
4. Counselors at different centers tend to use different patterns of sub-roles; however, some counselors are similar in sub-role pattern use to counselors in other centers.
5. The frequency of sub-roles played by counselors is related to the type of problem discussed.
6. The r_p statistic shows significant differences in sub-role patterns used by counselors in discussing different kinds of problems.

Range

1. Counselors tend to play a wide range of sub-roles; seventeen of the twenty counselors played more than 60 per cent of the fifteen sub-roles listed.
2. Counselors are quite consistent in their use of the number of kinds of sub-roles from client to client.
3. Counselors who use a low range of sub-roles differ significantly in the sub-role pattern they manifest from those who use a middle or high range of sub-roles.
4. The data suggest that the range of sub-roles used is not essentially differentiated by particular "centers."
5. The type of problem discussed by the client affects the counselor pattern of sub-roles more than it does the range of sub-roles played by the counselor.
6. Counselors are quite consistent in their use of the number of sub-roles from client to client.
7. Research is needed to explore the relationship between range of counselor sub-roles played and interview outcome. 293 pages. $3.80. Mic 57-294

TRENDS OF WORSHIP REFLECTED IN THE THREE EDITIONS OF THE BOOK OF COMMON WORSHIP OF THE PRESBYTERIAN CHURCH IN THE UNITED STATES OF AMERICA

(Publication No. 19,614)

David Rodney Bluhm, Ph.D.
University of Pittsburgh, 1956

Until the twentieth century the Presbyterian Church in the United States of America had no liturgical service-book. Increasing concern for Presbyterian liturgy led in 1906 to the publication of a Book of Common Worship by the Presbyterian General Assembly, and to subsequent editions of the service-book in 1932 and 1946.

The present study has made a comparative analysis of eight services found in each of the three editions: Sunday Morning Worship, Holy Communion, Baptism of Infants, Confirmation, Marriage, Ordination of Ministers, Funeral Service, and Treasury of Prayers. The contents of the services are analyzed in the light of their sources, the instructions of the General Assembly to the committees drawing up the three editions, and the influence of the social and religious conditions of the twentieth century.

The sources of structure for five of the services proved to be the Book of Common Order of the Church of Scotland (Presbyterian), together with the American Presbyterian "Directory of Worship" and "Form of Government." Confirmation and the Funeral Service followed in general the corresponding orders in the Protestant Episcopal Book of Common Prayer, while the Treasury of Prayers has its own indigenous structure.

Some items within the respective orders were drawn from the liturgies of John Calvin and John Knox, the English Book of Common Prayer, and the American Prayer Book; various ancient and medieval prayers were also used, altered when necessary to conform to Reformed theology; while prayers and statements from committee members and other modern writers also found a place in the three editions.

The instructions of the General Assembly to the committees drawing up the Book of Common Worship ordered (1) the use of Scripture and Scriptural forms of worship, (2) the use of Reformed liturgy, (3) the embodying of sound doctrine in devotional language, and (4) congregational participation in worship. The study has documented the particulars by which these instructions were fulfilled in the three editions.

A number of social and religious movements of the first half of the twentieth century were noted as influencing the content of the three editions. Most prominent among these were the world evangelism movement at the turn of the century; the interest in family worship and in the Christian nurture of the young; the rise of the labor movement and increasing liberal concern for social and international problems; the rise of neo-orthodoxy with its doctrinal emphasis; the liturgical movement with its fuller information concerning early Christian and early Reformed worship; and the ecumenical movement with its emphasis upon Church unity and Church union.

The study has indicated that the Book of Common Worship is based upon the Presbyterian liturgy established by John Calvin and John Knox. Calvin had written a service-book for his churches that proved widely influential, the various Calvinistic denominations of the Continent having retained such a liturgy continuously to the present. Knox also drew up a service-book, similar to Calvin's, which was used by the Scottish Presbyterian Church for one hundred years before being displaced by the "Directory of Worship" inspired by the Puritan movement in England. The Church of Scotland officially recovered its liturgy in the twentieth century with the publication of its Book of Common Order.

The study has also noted the many historic rapprochements between the Presbyterian and Episcopal Churches in the area of liturgy, concluding that the large body of liturgics held jointly by these two denominations should be a primary consideration in any future revision of the Book of Common Worship. 233 pages. $3.05. Mic 57-295

AUDIO-VISUAL COMPETENCIES NEEDED BY RELIGIOUS EDUCATION WORKERS IN PROTESTANT CHURCHES AND PRE-SERVICE TRAINING IN THESE COMPETENCIES

(Publication No. 19,379)

Ruth Camilla Haycock, Ed.D.
Syracuse University, 1956

This study deals with audio-visual competencies needed by students of religious education and the provisions being made for developing these competencies in institutions which train religious educators.

The study of needed competencies was made by sending questionnaires to 311 recent graduates in religious education and to 157 experts in the field. Each respondent was asked to indicate his opinion concerning the importance of thirty-seven competencies for workers in religious education, and whether or not he had personally needed the competency. On the basis of these data the competencies have been divided into several categories, according to their importance. In addition to this classification of competencies, data are included relating to attitudes toward specialized audio-visual courses for religious education students, hindrances to effective utilization in churches, and the value of several methods of overcoming hindrances.

Information concerning the provisions which colleges and theological seminaries are making for developing the needed competencies was gathered from three sources: (1) a questionnaire distributed to chairmen of eighty-one religious education departments, (2) a questionnaire distributed to students graduating with a religious education specialization, and (3) personal visits to six colleges and

seminaries in the New York-New England area. In this part of the study tabulation was made seeking to provide the following kinds of information:

1. Amount of audio-visual course work given; amount taken by a sampling of students.
2. Kinds of courses offered.
3. Percentage of schools in which all, some, or no students receive certain specialized kinds of audio-visual training.
4. Kinds of specific audio-visual training and experience possessed by graduating students.
5. Comparison of offerings of schools with needed competencies, according to recent graduates and experts.
6. Teaching methods used in audio-visual courses.
7. Relationship between faculty and student use of audio-visual materials.
8. Hindrances to greater use of audio-visual materials in content subjects.
9. Availability of audio-visual equipment and materials to faculty and students.
10. Facilities for darkening rooms.
11. Distribution of responsibility for audio0visual operator training.

When the data relating to pre-service audio-visual training are compared with the opinions and experience of recent graduates and experts in the field, certain deficiencies are noted: (1) faculty members in most institutions are not given adequate assistance and encouragement in the use of audio-visual materials in their own classes; (2) instruction for certain competencies is not provided for a large enough proportion of religious education students; (3) opportunity for student use of audio-visual materials is very limited in most institutions.

In the light of these deficiencies and on the basis of data collected, observations made, and literature in the field, seven recommendations are made for the improvement of pre-service audio-visual training for religious education students:

1. More adequate provision should be made for audio-visual equipment and materials to meet the needs of faculty and students.
2. An audio-visual budget should be established in each school.
3. One person should be appointed to be responsible for the coordination of audio-visual activity.
4. One central place should be designated as the repository for all audio-visual equipment, materials, and information.
5. Provision should be made for the distribution of audio-visual information and for in-service training for faculty members.
6. All students in religious education should receive training in a greater number of audio-visual competencies.
7. Greater provision should be made for meeting the diversified needs of students in religious education by offering some elective audio-visual instruction.

155 pages. $2.05. Mic 57-296

IDEAS OF GOD REFLECTED IN PUBLISHED SERMONS OF 25 AMERICAN PROTESTANT PREACHERS SELECTED AS "MOST INFLUENTIAL" IN 1924

(Publication No. 19,643)

Harold Theodore Porter, Ph.D.
University of Pittsburgh, 1956

This is a study of selected sermons published by 25 American Protestant preachers to ascertain the use of one tenet of theological doctrine, the idea of God. The preachers were selected as "the most influential" in a national poll conducted by The Christian Century in 1924. The sermons were published at various dates from 1895 to 1950.

The study shows the particular emphases relating to ideas of God which are employed in these sermons. It also demonstrates means used by the authors of interpreting and illustrating these views. Theological positions ranging from the most conservative to the more liberal are included. Varieties in theological opinion are reflected only to a limited extent. The major difference observed is the transcendental-immanental argument as this affects the view concerning revelation. The major theological contribution was to substitute for dogmatism two tests for validity: Is the doctrine applicable and is it reasonable? There is evidence that a preacher's theology significantly influences his preparation of sermons.

The main divisions of the dissertation are (1) the problem and media of knowledge concerning God; (2) the questions which reflect doubt and uncertainty about God; (3) God's standard to guide man's conduct; (4) attributes which are characteristic of God; and (5) God's relation to sin, judgment, mercy, and salvation. These are the concepts emphasized most in those data that delineate the ideas of God. The study reviews the teaching concerning these doctrines and those materials used to illustrate them.

There is evidence which describes the movement of thought from individualism to social concern. Theological concepts are formulated with reference to the secular crises. The primary fact is that these preachers were influenced by and sensitive to the "world situation." There are repeated examples relating their theological views to national and international crises and developments. These include war, scientific and technological revolution, changing educational philosophies and opportunities, literature, international affairs, politics, social reform, and missions.

These sermons can be characterized as life-sutiation, expository, and doctrinal. By far the main type aims at solving the life situations of actual people by leading the discussion to doctrinal and Biblical sources. The predicaments or problems which become subjects for sermons are personal, moral, intellectual, religious, psychological, social, and physical. Because of this treatment of personal need the sermon has new relevance. These data demonstrate the effective use of theology in relation to the life-situation sermon. This use of theology is more often apologetic than didactic.

The results support the investigator's assumption that the sermon is a method of religious instruction in which is presented doctrines, ideals, and standards corroborated by the Bible and theology. The documented evidence depicts prospective results which can be obtained when sermons are studied as teaching instruments.

181 pages. $2.40. Mic 57-297

A STUDY OF JEWISH THEOLOGICAL CONCEPTS AS REVEALED FROM AN ANALYSIS OF TEXTBOOKS ON JEWISH RELIGION, 1830 TO 1956

(Publication No. 19,648)

Simon Herbert Shoop, Ph.D.
University of Pittsburgh, 1956

An analysis of 76 textbooks on the Jewish religion written in English and used in the Jewish schools of the United States, 1830-1956, was undertaken with three objectives. The first of these was to ascertain their interpretation of Jewish theological concepts. The second objective was to discover and record any changes in their theological thinking. The last objective was to note emphasis placed on these concepts.

The textbooks were selected from all available sources, yielding a total of 76. Textbooks for all age levels were studied. The eight theological concepts which emerged from the analysis for the purpose of this study were as follows: God and His Attributes; God and His Relationship to the World; Man–his Theological Nature; Man–his Duties; Torah; Messiah; Israel; Immortality, and Reward and Punishment.

For the purpose of determining comparative emphases and to provide a chronological survey of the attitudes in regard to the eight concepts, the period 1830-1956 was divided as follows: 1830-1849; 1850-1874; 1875-1899; 1900-1924; and 1925-1956. The number of books analyzed for each of these periods was 3, 15, 11, 12, and 35 respectively.

The 76 textbooks were closely scrutinized and a study made of every reference in them to the theological concepts. Each concept was reported in this study in its detailed treatment over a span of 125 years. Changes in meaning were presented. Emphasis was noted according to the number of textbooks mentioning the concept.

It was found that each concept had been dealt with in the textbooks under various categories. All categories of the following concepts are arranged in order of emphases:

(1) God and His Attributes–15 categories: God is One; Incorporeal; Eternal; Just; Love; Almighty; Omnipresent; Omniscient; Good; Holy; Wise; Perfect; Immutable; True; and Inconceivable.

(2) God's Relationship to the World-seven categories: God is Creator, Ruler, and Sustainer of the universe; God is Preserver of the universe; God's existence is proved by the orderliness of the universe; God's existence is based on revelation; God's existence is based on innate reason within man; God's existence is based on evidence of moral power in history; and the Problem of evil and suffering.

(3) The Concept of Man–eight categories: Man's duties to God; Duties to fellowman; Theological nature of man; Man possesses free will; Duties to self; Man is endowed with reason; Nature of sin; and Man is endowed with conscience.

(4) The Concept of Torah–six categories: Torah is the word of God; Torah promotes human happiness and its study is important Explanation of Ten Commandments; Torah is unchangeable and binding; Torah is the work of man written over a period of years whose authority is not binding; and Creeds and Guiding principles in Jewish life.

(5) The Messiah–three categories: Characteristics of the Messianic Era; Messiah is not a human–no personal Messiah; and Messiah is a human.

(6) Israel-four categories: Israel is to serve as a kingdom of priests; Israel is the chosen people; Israel's dispersion is the result of sin; and Israel's dispersion is part of divine plan to carry out its mission.

(7) Immortality, and Reward and Punishment–three categories: Immortality of the soul; Nature of reward and punishment and Resurrection.

The study revealed that the meaning of some of these concepts underwent change while the traditional interpretation remained constant throughout the entire period of the study. Noticeable changes occurred in the interpretation of the concepts of Torah, Messiah, Israel, and Immortality under the influence of Reform thinking. In the earlier periods of study the traditional interpretation of concepts prevailed; in the last period only six of 35 books presented the traditional approach. The two concepts of God and Man, only in the last 25 years have shown evidence of a tendency to reinterpretation under the influence of Reconstructionist thinking and this change was found in only four of the 35 books of the last period. 265 pages. $3.45. Mic 57-298

SOCIAL PSYCHOLOGY

SOME SOCIAL PSYCHOLOGICAL FACTORS IN STABILITY OF RESPONSE IN ATTITUDE SURVEYS

(Publication No. 19,773)

Raymond Fink, Ph.D.
Cornell University, 1956

The relationship of individual and social factors to stability of response in attitude surveys was tested in this study. As a test of the generalizability of the findings, panel studies using a sample of Cornell University undergraduates and a sample of adults from Elmira, New York, were employed.

First, the following hypothesis was tested: "The greater the personal involvement in an attitude or in an attitude subject area, the greater the stability of response, provided that the original response is not an "Undecided," "Don't Know," or other nondefinitive response." By personal involvement was meant those dimensions of attitude that may vary in strength, importance, sureness of feeling, and saliency.

For each test of personal involvement used, where there was greater personal involvement there was greater stability of response between Time I and Time II. Respondents who answered that they got "worked up" over politics were more stable on political items than those who did not get "worked up"; respondents who felt strongly about their answers to various questions were generally

found to be more stable than those who did not feel strongly; those who felt an issue to be important were more stable in their responses on items related to that issue than those who did not consider the issue important; respondents considering an item to be "essential" were more stable than those not considering that item "essential"; a positive correlation was found between how an item was ranked numerically in importance, and the stability of response on that item.

It was also found that respondents having extreme scale positions (positive or negative) on a unidimensional scale were more likely to retain their scale positions over time than those in intermediate scale positions. Further, there was evidence that the stability pattern of scale responses follows the U-shaped or J-shaped pattern of the intensity component of a Guttman Scale when it is plotted against the content of the scale items.

Testing the hypothesis that those giving consistent responses have a better attitude structure, and should therefor be more stable in their responses, the following was observed: (1) Respondents consistent on two items were more stable on both items; (2) stability was lowest in the "Zero" cell in a unidimensional scale; (3) respondents who were perfect scale types tended to remain perfect scale types, while nonscale types tended to become scale types; (4) perfect scale types were more likely than nonscale types to retain both their same scale position and their same response pattern over time.

With regard to social factors in the stability of response, it was found that, in general, knowledge about the attitudes prevailing in respondents' membership or reference groups serves to improve predictions about the stability of response. For a large sample of items, it was noted that the greater the proportion of respondents in a category, the greater the stability of response in that category. Also, where two or more groups differed from each other in their response patterns for an item, it was found that for each response category, stability was greater for the group with the highest proportion of respondents giving that response on the first questionnaire wave.

Using a three-wave panel, it was consistently found that respondents changing their attitudes from Time I to Time II were more likely than "nonchangers" to change their attitudes from Time II to Time III.

The findings of this study were generally consistent whatever the subject matter used, and whatever the group used for testing the hypotheses.

375 pages. $4.80. Mic 57-299

INFLUENCING ETHNOCENTRISM IN SMALL DISCUSSION GROUPS THROUGH A FILM COMMUNICATION

(Publication No. 17,813)

Leonard L. Mitnick, Ph.D.
University of Maryland, 1956

Supervisor: Dr. Elliott McGinnies

This study investigated the effects of audience predisposition, treatment, and participation in discussion on learning and attitude change. Predispositions were high, medium, and low score on a modified form of the California Ethnocentrism scale. The treatments were control, film-only, and film-discussion. Participation was categorized as follows: active participants who took part in a free discussion, passive participants who made no comments during the discussion and no-participation Ss who were not present in a discussion. One hundred sixty-two students of two high schools in Prince George's County, Maryland, participated in the study.

The subjects were stratified into three levels of predisposition. Within each level fifty-four subjects were assigned at random to one of three treatments in a 2x3x3 factorial design. The two schools were the third independent variable. Nine groups were formed in each school, each composed of nine subjects with similar scores on the E scale. The film-discussion group members were further designated as active participants or passive participants, according to whether they participated in the discussion or not. For the film-discussion groups the experimental treatment consisted of viewing a film "The High Wall," followed by a discussion. The film-only groups viewed the film, but no discussion followed. Immediately following the experimental treatments, the E scale was readministered to all subjects, the controls being tested without having seen the film. The experimental groups were given an Information Test after the E scale. Measures were thus obtained on change of attitude and learning from the film. One month after treatment the control, film-only, and film-discussion groups were retested on the E scale to determine retention of attitude change. The groups who had seen the film were also tested for their retention of information. A tape recording was made of all the discussions, and from the typed transcript of these recordings the number of participants and content of participations for each member was determined in the several groups. The major results of the investigation indicated that groups assumed to be more favorably disposed to the film learned more information than those opposed to it. Discussion following the film did not increase learning of information nor did it increase attitude change over that displayed by the film-only groups. Both experimental treatments produced significant changes in ethnocentrism. However, neither the active nor passive participants in the discussion groups regressed significantly from their post-treatment measure when tested one month after treatment, whereas the film-only group did show the change. Those subjects who learned most material were the active participants in the discussion groups. Significant differences in the content of the discussion as well as number of participations were observed. These variables were related to the initial attitude of the subjects. Other studies have obtained somewhat different results for active and passive participations. This may be due to the type of participation technique. Suggestions for future research have been presented.

113 pages. $1.50. Mic 57-300

EFFECTS OF ROLE INTERDEPENDENCE AND EGO STRENGTH ON GROUP FUNCTIONING

(Publication No. 19,723)

Edwin John Thomas, Ph.D.
University of Michigan, 1956

The purpose of this study was to investigate some of the effects of role interdependence and individual ego strength upon interpersonal relations and group behavior. These two independent variables were investigated in the same study on the assumption that both were determinants of similar behaviors among group members.

A theory was formulated concerning what was termed facilitative role interdependence. Facilitation was viewed as occurring in two ways: by making available to a person paths for movement toward his goal (called "task" facilitation), or by providing actual movement of that person toward his goal (called "goal" facilitation). Role interdependence was viewed as a condition in which two or more persons are mutually dependent regarding their respective role performance.

A basic assumption was that increases in facilitation among interdependent persons would create fewer restraints of group members in role performance, but also would result in greater tension in role performance. Hypotheses were evolved from the theory which were, in brief: the greater the facilitative role interdependence, the greater the (a) strength of responsibility forces on members, (b) emotional tension, (c) group cohesiveness, up to moderate degrees of facilitation, (d) likelihood of higher self evaluation, and (e) speed of movement toward the goal.

By ego strength was meant the ability of the person to control emotional tension and to direct behavior in an assertive fashion in the environment. The hypotheses, in brief, were: the higher the ego strength of the person, the greater the (a) likelihood of higher self evaluation, (b) ability to withstand the effects of emotional tension, (c) attraction to the group, and (d) speed of movement toward the goal.

A measure of ego strength was constructed on the basis of the theory. An independent validation study was conducted in which scores on ego strength of selected psychotics and normals were contrasted. All evidence indicated that the measure was sufficiently valid and reliable for the present study.

Hypotheses were tested in a laboratory experiment. Female subjects (160) worked in groups of five on a task of constructing miniature houses of cardboard, which was introduced as a test of "General Work Intelligence." A 2 x 2 x 2 factorial design was used. High and low ego strength was varied by assigning subjects to treatments on the basis of scores obtained beforehand. The task consisted of five ordered steps. High task facilitation was created by assigning two steps of the task to each person so that all contiguous pairs of persons were interdependent; low task facilitation was created by assigning all steps to each person so that all persons were independent. High goal facilitation was created by giving a group score on the test; low goal facilitation was created by giving individual scores on the test. The various combinations of facilitation treatments provided degrees of facilitation.

The results provided support for a majority of the hypotheses. On the basis of the results in this study, it was concluded that (a) the theory of facilitative role interdependence had been supported, (b) the conceptualization of ego strength had been supported, (c) the measure of ego strength was valid and reliable, and (d) predictable differences for ego strength are most likely to be secured when persons do not experience strong pressures for behaving from the group situation. 243 pages. $3.15. Mic 57-301

A STUDY OF REASONS FOR AIRMEN CHOOSING TO REENLIST OR LEAVE THE AIR FORCE

(Publication No. 17,180)

Samuel Paul Daykin, D.S.W.
Washington University, 1956

Chairman: William E. Gordon

This study seeks to identify reasons which were decisive for airmen choosing to stay in or leave the United States Air Force. If these decisive reasons can be validly identified, they should be useful as a basis for personnel policy changes, which in turn will hopefully curtail continued loss of trained and experienced airmen.

In order to identify the reasons which were decisive for airmen choosing to stay in or leave the Air Force, the researcher interviewed 193 airmen shortly after they had made their decision to stay in or leave the Air Force. The interview permitted the drawing out of the personal and social background of beliefs and feelings of the airmen, which provided for seeing in fuller context what went into the airmen deciding to stay in or leave the Air Force. This was considered essential to a valid determination of the reason for each airman's choice.

The decisive reason for staying or leaving was identified for each of the 193 airmen. These reasons were grouped first into nineteen categories and finally four. The classes were determined as far as possible by the natural commonalities in the data and as little as possible by the researcher's pre-determined ideas of what the significant kinds of reasons would be.

The sample of 193 Scott Air Force Base airmen contained 101 airmen who reenlisted for Air Force service, and 92 airmen who, although eligible to reenlist, left the Air Force for civilian life. The reenlistee and separatee samples were selected to be representative of their respective populations.

From the Scott Air Force Base August, 1955, Sample Survey, some items such as age, educational level, and

marital status characteristics were related to the basic interview data of the study. A special supplement to the November, 1955 Scott Air Force Base Sample Survey was prepared and administered to test certain tentative conclusions based on the reasons determined in the interview sample.

This study showed that the three most important decisive reasons for which nearly three fourths of the airmen chose to stay in the Air Force were: retirement security, money and job security, and family economic security. The three most important decisive reasons for which nearly nine tenths of the airmen chose to leave the Air Force were: self-improvement opportunity, individual liberty, and individual or family liking for being settled down in a stabilized residence.

The interview sample study and the August Survey both showed that older, less formally educated, and married airmen more often chose or intended to stay in the Air Force, while younger, more formally educated, and single airmen more often chose or intended to return to civilian life. Also, in general, the responses of a Basewide sample of airmen to the November Sample Survey Supplement were in conformity with expectations derived from the reasons found in the interview sample.

This study of reasons for airmen choosing to reenlist or leave the Air Force permits some conclusions of significance to the problem of the high losses of experienced manpower in the Air Force. Data from the November Sample Survey Supplement showed that decisions about reenlistment intentions made after enlistment slightly favored staying over leaving but used as a measure of the persuasive effect of actual Air Force life, the latter does not appear to be an impressive factor in retaining men for the Air Force.

For the period of this study, the Air Force appeared to be appealing more to those airmen seeking long-range but modest economic and job security, and not appealing to those who placed a high value on individual freedom and greater self-development opportunities. The net effect of this self-selection process operating over a period of time on the quality of the Air Force is obvious. Therefore, in addition to providing those benefits which are in the nature of economic security for all airmen, every effort needs to be made to create greater opportunities for those airmen who are able and desirous of substantial self-development to achieve their goals within the Air Force.

99 pages. $1.50. Mic 57-302

SOCIOLOGY

SOCIOLOGY, GENERAL

THE SOCIAL PARTICIPATION OF RETIRED MEN IN FORMAL ORGANIZATIONS

(Publication No. 20,022)

Norman William Henry Ofslager, Ph.D.
Cornell University, 1956

The central problem of this research is concerned with the lack of a definite place for the aged in the societal structure as a result of retirement. The three objectives were: 1) to determine the change in the formal participation of persons after retirement; 2) to determine factors relevant to this change in post-retirement formal participation; 3) to determine factors relevant to the leadership of the elderly in formal organizations after retirement.

To investigate these objectives, hypotheses concerning the formal participation of retired men were posited for testing. The data were collected from a highly industrialized urban community. The sample consisted of 265 retired men 65-74 years of age of all socio-economic levels.

An analysis was made of the formal organizational activities of these men prior to and after retirement. The number of organizations, the type, the amount of participational activity, and the position of leadership in the organizations were examined. A lesser amount of participation was found to exist after retirement than before for the total sample. This decrease was seen to be associated with the amount of pre-retirement participation, with the type of organizational affiliation during the younger years, and with status as delineated by occupation. Formal participation in retirement was found to evidence a reduction in relation to status differentials. Thus, the loss of occupation, or retirement, was seen as a factor in the isolation of the aged in our society.

While tending to support Parson's statement with respect to the isolation of the aged, the data indicate his theory is more applicable to individuals of pre-retirement low status than to those of high occupational status before retirement. From the data, three concepts emerge: 1) organizational activity in the retired years is dependent upon participational activity in the earlier years; 2) retirement tends to effect a change in the societal position of the individual, in that retirement is concomitant with the loss of occupational status, affecting the formal participation of men of lower status to a greater degree than men of high status; 3) the maintenance of organizational life after retirement is to some degree dependent upon the type of formal affiliations prior to retirement. These concepts suggest primarily that life in retirement is fundamentally based upon the cultural boundaries and social interactions of the individual prior to retirement.

Additional socio-economic factors were found to determine the boundaries of the individual's culture and his place in society. Again, status was seen to be an important factor associated with organizational life in the later years. Those socio-economic factors which were found associated with high status were in turn found to be associated with a high level of post-retirement formal participation.

In the analysis of leadership in formal organizations, the data indicated that leaders in formal organizational life after retirement were leaders prior to retirement, that a decrease was manifested in the amount of leadership after

retirement, and that this decrease was seen to differentiate with respect to the socio-economic status of the leader. The findings indicate that it is the elderly individual with a favorable combination of cultural and social conditions reflecting high status who is able to maintain the post-retirement position of leadership.

The analysis of the problem of the effect of retirement on the formal participation of the elderly demonstrates that the system of American social stratification affects social behavior in retirement as well as throughout the individual's working years. The data indicate that men of upper socio-economic characteristics dominate the community associational life in retirement in addition to supplying the community with leadership. Men of low status are more inclined to be isolated from organization activity and community life. 177 pages. $2.35. Mic 57-303

THE SOCIAL AND OCCUPATIONAL STABILITY OF ALCOHOLICS – A STUDY OF 830 MALE PATIENTS IN A PRIVATE SANITARIUM

(Publication No. 17,522)

Wayne Myron Wellman, Ph.D.
State College of Washington, 1956

Earlier impressions of low social and economic stability among alcoholics were reversed by Straus and Bacon's 1951 study of alcoholic clinic patients. The present study of a sub-group of alcoholic patients at the Shadel Sanitarium, Seattle, Washington, was undertaken to test the general hypothesis that the Shadel patients would show an even greater social and occupational stability than had characterized the Straus and Bacon clinic patients.

For purposes of this study, social and occupational stability was defined as the individual's ability to act and react in socially acceptable ways.

A systematic sample of 830 male patients was taken from a larger sub-group of 2,048 male and female patients.

All patients in the sample, as well as the larger sub-group, had been given a narco-psychiatric interview by means of sodium pentothal. From the larger questionnaire, 28 questions were selected which had some bearing on the social and occupational stability of alcoholics.

The findings of this study gave support to the general hypothesis. The direct comparisons with the Straus-Bacon study revealed that:

1. A larger percentage of alcoholics were married and living with their spouses than was discovered in the clinic study by Straus and Bacon.
2. A smaller percentage of alcoholics were single than discovered in the clinic study by Straus and Bacon.
3. A smaller percentage of alcoholics were separated or divorced than discovered in the clinic study by Straus and Bacon.
4. A larger percentage of Shadel alcoholics were found in a classification of higher occupations than was discovered in the clinic study by Straus and Bacon.
5. A larger percentage of Shadel alcoholics were employed than was found in the Straus and Bacon study.

Furthermore, the analysis of certain self-evaluation data revealed that a large percentage of Shadel patients stated that they had:

1. A happy childhood.
2. Good relations with their parents.
3. A lack of resentment toward parents.
4. A love bond between self and wife which was mutual.
5. Satisfactory sex adjustment.
6. Stabilizing life goals.
7. Freedom from financial worries.
8. Job satisfaction.

From research previous to the Straus and Bacon study, there had emerged a picture of a generally low degree of social and occupational stability among alcoholics. Shadel patients revealed an amount of social and occupational stability which not only supports Straus and Bacon's reversal of earlier impressions of low social and occupational stability among alcoholics, but which even exceeds the amount of social and occupational stability found among the Straus and Bacon clinic patients.

The findings of this study weaken the tenability of any hypotheses existing in the field of alcoholism which identify alcoholism as a "poverty disease," a product of economic insecurity, or that associate it chiefly with skid row, rooming house areas or mental hospitals.

Another implication flowing from the findings in this study has to do with the nature of personality disorganization in the case of an alcoholic. That is to say, personality disorganization, in the case of many alcoholics, may not necessarily be a total, all-encompassing process, but may be confined to a restricted area of the total personality – at least for a substantial length of time.

Many alcoholics must still be hidden from public view either by their friends and relatives or by their own ability to appear socially and occupationally stable for a considerable period of time. 84 pages. $1.50. Mic 57-304

AN INVESTIGATION OF THE SPEECH OF PRE-SCHOOL CLEFT PALATE CHILDREN

(Publication No. 18,970)

Kenneth Rudolph Bzoch, Ph.D.
Northwestern University, 1956

The study explored the nature and the extent of the speech deficiency of a group of pre-school cleft palate children as well as the structural and environmental factors which might account for the deficiency.

The first phase was a comparison of data from a speech sound test consisting of eighty-two elements. Mean speech test scores and percentages of correct responses of a group of sixty cleft palate children between three and six years of age were compared with the scores on a group of one hundred and twenty children without cleft palates. The latter group was selected to be similar to the cleft palate group on factors of age, sex, and family socio-economic level. Differences between the two groups were determined for half year age groupings and the data were analyzed to show differences for the total test, each sound class, each individual consonant sound, and other phonetic variables. A comparison of speech sound errors was also made as to the frequency of substitution, distortion and omission errors in each group and the nature of each of these error types. Results of rating scales of understandability of connected speech and the extent of resonance distortion were also compared and data describing the early speech development of the cleft palate children were compared with the established norms.

The second phase of the study was a description and evaluation of the structural and environmental hazards to speech encountered by the cleft palate sample. The possible structural speech hazards of the group were described in terms of their frequency of occurrence. The relative importance of each to speech proficiency was investigated by comparing the speech test scores of matched cleft palate sub-groups with and without particular speech hazards. Case history and Vineland Social Maturity data were described in order to indicate other possible speech hazards.

The findings of this study showed that the three year old normal children were actually more proficient in speech sound production than the five year old cleft palate children. Differences in speech sound proficiency were found to be extensive throughout the three year range. These differences were most extensive for two-consonant blends, the plosives and the fricative sounds. They were less marked for the glide sounds and only slightly apparent for the nasal and the vowel sounds. The cleft palate group improved slowly but steadily with maturation while the normal group showed the usual accelerated curve. Other differences were also described including the finding of delay in first word use for 50% of the cleft palate children. It was found that all structural factors related to sufficiency of velar-pharyngeal closure had a measurable influence upon speech proficiency of the cleft palate children. The cleft palate children with limited (incomplete) palatal clefts had poorer speech than those with complete clefts. The children with good velar mobility and good activity of the muscles of the oral and naso-pharynx, when these structural conditions were not complicated by a concavity of the posterior naso-pharyngeal wall or by a restriction of velar movement by the posterior pillars, had significantly better speech than similar cleft palate children without these structural conditions.

The general conclusions of the study were that on the average, the speech of the pre-school cleft palate children was considerably deficient, speech errors were mostly functional and were of a very gross nature. The efficiency of velar-pharyngeal closure was of greatest importance to speech of all the structural deviations at this age level.

254 pages. $3.30. Mic 57-305

A CLINICAL STUDY OF THE SPEECH EFFICIENCY AND STRUCTURAL ADEQUACY OF OPERATED ADOLESCENT AND ADULT CLEFT PALATE PERSONS

(Publication No. 18,976)

Donald Thomas Counihan, Ph.D.
Northwestern University, 1956

This study deals with the speech sound ability of operated adolescent and adult cleft palate persons with respect to single consonant elements, consonant sound blends, vowels, and continuous speech; with the suitability of the operated structures for speech; and with the relationships between the adequacy of the speech structures and speech efficiency. Data used in these analyses were derived from a test of speech articulation, ratings of samples of recorded speech, a systematic clinical appraisal of the speech structures, lateral and antero-posterior cephalometric headplates, and medical and social history information. Fifty-five subjects were studied. Inter-group comparisons were made, for the most part, using a non-parametric test devised by Mann and Whitney.

Correct production of consonant elements was analyzed with respect to (1) the position of a sound in a word; (2) the place of articulation; (3) the phonetic aspects of the sound; (4) the type of cleft; (5) the age of operation; (6) the age of the subject; (7) the sex of the subject; and (8) voiced and voiceless sounds. An analysis was also made of the type of error, i.e., indistinct production, substitutions, omissions, and errors due to nasal emission. Percentage scores for the correct production of consonant blends and vowel sounds were computed. Ratings of understandability and resonance distortion were made.

Subjects were evaluated clinically with respect to the adequacy of their occlusion, dentition, maxillary arches, palatal vaults, posterior pillars, velar length and mobility, and pharyngeal wall movement. From the cephalometric

headplates, judgments were made of the degree of adenoid convexity, the degree of nasal cavity occlusion, and the degree of vertical and anterior growth arrest. In addition, measurements were made of the size of the velopharyngeal opening during phonation of the vowel (u).

The third part of the study deals with comparisons between subjects with varying degrees of structural disturbance with respect to their scores for consonant sound articulation, intelligibility ratings, and resonance ratings. Intelligibility ratings were derived from ratings of each of the recorded speech samples by 56 judges; resonance ratings, by 50 judges. Inter-correlations were made between scores for consonant sound articulation, intelligibility ratings, and ratings of resonance distortion.

The general conclusions of this study are: (1) that indistinct production of consonant elements and blends constitutes the major problem in articulation for these subjects; (2) that the speech structures, in many subjects, are sufficiently disturbed to constitute a hazard to speech; (3) that there appears to be a relationship between structural inadequacies, even when considered as single factors, and speech efficiency; and (4) that the problems of articulation, intelligibility, and resonance distortion are interrelated. 302 pages. $3.90. Mic 57-306

THE STRUCTURE OF SEAN O'CASEY'S PLAYS

(Publication No. 19,925)

Emery Clayton Garrison, Ph.D.
Stanford University, 1956

This investigation examines in detail problems related to the structure of Sean O'Casey's plays. The study attempts to analyze the functions of the components of a play in relationship to the total unifying effect of the whole drama, and, by comparing the constructional patterns chronologically, to examine the effect of changes in structure on the unity of the plays. The fact that no major structural examination of O'Casey's plays has ever been undertaken and that the conclusions of the critics who have written more limited studies are subject to review seems adequate justification for a full-length study on the structure of O'Casey's plays.

In examining O'Casey's composition, the problem is one of discovering how the playwright synthesizes the parts of a play to secure dramatic unity. The scientific mode of literal criticism, based on an extension of Aristotle's Poetics, seems most applicable to a study concerned with questions regarding the structural properties peculiar to a specific play. The writer attacks each play by: 1) discovering the principle of organization; 2) examining the qualitative divisions of action; 3) determining the controlling form; and 4) investigating the function of structure in relation to the form.

The chronological changes in structure created four groupings, namely: the early, transitional, middle, and late plays. The Shadow of a Gunman, Juno and the Paycock, and The Plough and the Stars reveal that a change in the action unifies each of the plots of these realistic plays of the early period, and that the parts function in relation to O'Casey's blend of sardonic comedy and tragic irony. In the transitional plays, O'Casey changes the probability in his structure from the realistic mode of the early plays to a more abstract level, organizing his material less around the principle of action, and more around the change in character in the modified expressionism of The Silver Tassie, and the dramatic thought in the allegorical Within the Gates. The plays of the middle period represent a compositional synthesis of the structure and the style of the early and the transitional plays. The symbolic characters and their actions in The Star Turns Red are organized by a dialectical argument. A change in the action provides the dramatic unity for the first of O'Casey's full-length comedies, Purple Dust. Although Red Roses for Me derives its politics from The Star Turns Red, it is similar to the early plays in its delineation of character and in its organizational principle, and it resembles the transitional plays in the hero's expressionistic vision. The sardonic tone of the tragic and comic forms, and the symbolism in the levels of probability unite the three late plays as censorious fantasies. The first two of the late plays are organized by action. Oak Leaves and Lavender, with its shadows among substances, censures the fascists as barbaric enemies of man. Cock-a-Doodle Dandy, with its whimsical cock, censures the corrosive effect of institutional morality on individuals. Organized by thought, The Bishop's Bonfire, with its wailing statues, censures chastity and religious hypocrisy. In all of the plays, the vigorous rhythm in the dialectal prose rises to poetic heights; and the playwright's integration of music underscores the philosophy of plot.

This study attempts to show that when the parts of the dramas are analysed in relation to the whole, there is clarity in the construction of O'Casey's plays: 1) a principle of organization unifies each plot; 2) a prevailing form controls the structural components; and 3) the changes in the development of the playwright's style modify the level of probability and the controlling form, but do not affect the unity of the plots. This investigation is an attempt, then, to demonstrate the unity in the structure of Sean O'Casey's plays. 349 pages. $4.50. Mic 57-307

EFFECTS AND INTERACTIONS OF DELAYED SIDE-TONE AND AUDITORY FLUTTER

(Publication No. 18,873)

Henry E. Spuehler, Ph.D.
Purdue University, 1956

Major Professor: T. D. Hanley

A survey of the literature involving investigations concerning delayed side-tone and auditory flutter indicates that no investigation has been made of the interaction of the two phenomena. The purpose of this investigation was to establish, by means of statistical analysis, the effects and interactions of delayed side-tone and auditory flutter on certain measurable aspects of the speech of normal hearing individuals. The investigation was concerned with three speech variables: reading rate in words per minute, phonation time ratio and average speech power.

The procedure employed consisted of the following basic steps:

1. Administration of 31 randomized combinations of six levels of delayed side-tone and five levels of

auditory flutter to subjects reading a standard passage.
2. Statistical treatment by the analysis of variance technique of the data collected.

Test results revealed that male and female groups performed significantly differently with respect to phonation time ratio. No other significance for groups was found; however, the tendency for the male subjects to be less affected by the experimental conditions than the females was noted for all three speech variables. For the most part, specific side-tone delay times did not predict the extent of modification of the speech attributes. Nevertheless, an inverse relationship seemed to exist between the length of side-tone delay and the amount of deviation from the normal in the words per minute difference values analyzed. The main effects of delay and flutter were found significant in all three analyses. Individual comparisons of the cell means in the three analyses of the investigation consistently revealed that the no-delay, no-flutter conditions affected the subjects differently than the other conditions.

Within the limitations of the present investigation, the following conclusion appears to be justified:

A. Normal hearing individuals will react to auditory side-tone presentations and auditory flutter rates by deviations in the following vocal characteristics:

1) Words per Minute:
   a) In the shortest delay condition (.15 second) the deviation from normal reading rate is most marked, with a reduction in verbal output in words per minute. With increasing delay, the deviation from normal reading rate is reduced. This finding, which is in direct contrast with most of the previously reported research in side-tone delay, is offered without explanation, except to note that the combination of auditory flutter with delayed feedback was a unique feature of this experiment.
   b) The lowest rate of auditory flutter is associated with a mean difference value in reading rate which is opposite in direction from the other results. That is, at three interruptions per second there is a slight increase in reading rate. As interruption rates rise, up to 3000 per second, reading rate is reduced.

2) Phonation Time Ratio:
   a) Male and female groups are differentially affected by combinations of delay and flutter, with the female groups revealing a greater increase in the ratio than the male group.
   b) In the absence of side-tone delay, all flutter conditions are found to have less effect on phonation time ratio than combination flutter and delay conditions and delay conditions alone.
   c) The lowest rate of auditory flutter yields results approximately equal to those of the no-flutter condition. As interruption rates rise, up to 300 per second, phonation time ratio is increased. A reverse trend, toward a lower phonation time ratio, is associated with the 3000 interruption per second flutter condition.

3) Average Speech Power:
   a) The effects of the delay conditions are similar to those described for phonation time ratio.
   b) The effects of flutter conditions are also similar to those described for phonation time ratio.

B. In general, male subjects tend to be less affected by the presentation of combinations of delayed side-tone and auditory flutter than female subjects.

C. Exposure to a series of combinations of delayed side-tone and auditory flutter has some immediate carry-over effects on the speech of the individuals so exposed: significant differences are found in "before and after" analysis of reading rate, phonation time ratio, and average speech power.

D. A final conclusion, based on the results of this experiment, is that additional support has been found for theoretical speech models in which feedback controls are an important feature. Feedback delay again has been demonstrated to have marked effect on speech output. Also auditory flutter, which serves to reduce by one-half the amount of information fed back to the signal source, has been shown to have similar effects.

116 pages. $1.50. Mic 57-308

A LAMINAGRAPHIC STUDY OF NASALIZED VOWELS PRODUCED BY CLEFT PALATE SPEAKERS

(Publication No. 19,050)

Joanne Davis Subtelny, Ph.D.
Northwestern University, 1956

The purpose of this study was to investigate the physiologic basis for hyper-nasality in cleft palate individuals. A sample of 32 normal and 31 cleft palate individuals were studied and compared. Samples of continuous speech were recorded for each of these subjects. Also, sustained vowel phonations were recorded at the time mid-sagittal laminagraph x-rays were obtained.

Judgment ratings of the degree of nasality were secured by playing back the recordings of the continuous speech and the sustained vowels to a panel of three phoneticians. The degree of nasality was rated on a four point scale. Each sustained vowel was also phonetically identified.

The analysis of the judgment data revealed:

1. Marked speaker variability in degree of nasality was evident in the cleft palate group during sustained vowel phonations.
2. Variability in degree of nasality as a function of the vowel was found to be statistically significant in both the normal and the cleft palate groups.
3. Closed vowels [i] and [u], in both groups, were produced with less nasality than the open vowel [æ].

4. The sustained vowels of the cleft palate individuals were judged significantly less nasal than samples of their continuous speech.
5. The difference between normal and cleft palate voice quality was most apparent during continuous speech.
6. In normals, vowels [i] and [u] were produced with greater accuracy and stability than the open vowels [a] and [æ].
7. Judgments of phonetic accuracy and phonetic stability were similar for both normal and cleft palate groups.

The information regarding the speech samples enabled the selection of individual subjects whose laminagraphic x-rays could be studied with most profit. After deleting all inaccurate unstable and moderately nasalized vowels, the samples for physiologic analysis included: 30 normal and 16 hyper-nasal cleft palate subjects during phonation of vowel [u], 25 normal and 17 hyper-nasal cleft palate subjects during phonation of vowel [i], 20 normal and 5 hyper-nasal cleft palate subjects during phonation of vowel [a], and 5 normal and 7 hyper-nasal cleft palate subjects during phonation of vowel [æ].

The x-ray laminagraphs of the vowels of the individual samples indicated above were traced. The method employed in physiologic analysis included area and length measurement of cavity space as revealed in the mid-sagittal plane and linear measurements of apertures or constriction points.

The physiologic analysis of the laminagraphic tracings revealed:

1. Regardless of the vowel considered, the hyper-nasal cleft palate individuals showed significant deviations in cavity and aperture relationships or in resonating characteristics.
2. These differences were not limited to velo-pharyngeal relationships. Nor were velo-pharyngeal deviations the only consistent sources of deviation during the phonation of all four vowels studied.
3. Just as consistent as the more open degree of velo-pharyngeal constriction in the hyper-nasal cleft palate group were: shorter oral cavity dimensions, lower angular positions of the velum, lower hyoid positions, lower vertical tongue postures, and aberration in horizontal adjustment of the tongue within the shortened anterior posterior dimensions of the vocal tract.

Physiologic adjustments, imposed by the abnormality of the superior boundary of the vocal tract, were noted in areas relatively far removed from the site of the palatal anomaly. These adjustments have been considered compensatory in character, and were found to differentiate clearly the hyper-nasal cleft palate subjects from the non-nasal normal subjects.

Since a total or wholistic type of adjustment to the palatal distortion and constriction was observed, the significance of total adjustment in continuous speech was considered. The system concept in which all parts are interdependent is presented. Such a concept appears to physiologically fit the compensatory findings of this and other studies of cleft palate speech.

203 pages. $2.65. Mic 57-309

MATERNAL-FETAL GAMMA-GLOBULIN RELATIONS IN THE ALBINO RAT

(Publication No. 19,770)

John Walberg Anderson, Ph.D.
Cornell University, 1956

It has been shown by previous workers that fetal rabbits obtain antibodies from their mothers by absorbing these proteins from the uterine lumen by way of the visceral wall of the yolk sac and the vitelline circulation. Since the rat fetus has been shown to obtain a much lower titer of antibodies prenatally, it was decided to investigate the nature of the placental barrier to proteins in the rat. For this purpose, gamma-globulins were isolated by the low temperature-ethanol method, labelled with I^{131}, and injected into rats at various stages of gestation. Quantitative aspects were studied in later stages of pregnancy by scintillation counting procedures, comparing activities of fetal livers and maternal sera. Histological relations were determined by making autoradiographs of entire gestation sacs removed after 11, 15 and 17 days of pregnancy.

It was found that there is indeed a very low rate of transfer of gamma-globulins from mother to fetus in the rat, and that the trophoblast seems to constitute the barrier in the chorioallantoic placenta. In addition, the autoradiographs showed that the gamma-globulins entered the yolk-sac cavity in all stages studied, both before and after rupture of the parietal wall of the yolk sac. As far as the method permitted, it was decided that the gamma-globulins entered the visceral entodermal epithelial cells, and probably were stopped in the apices of these cells.

The ready passage of the proteins to the yolk-sac cavity can best be explained on the basis that substances in the maternal bloodstream do not have to cross the trophblast to gain entrance to the yolk-sac cavity in the rat, since maternal blood probably bathes Reichert's membrane directly. The lower efficiency of the yolk sac of the rat fetus in transferring gamma-globulins to the vitelline circulation has two possible explanations. Since it has been found that toluidin blue is reduced to the leuco base on passage through the cells of the visceral epithelium, the indicated high metabolic activity may cause a degradation of the proteins which gain entrance to the cells. A possible anatomical explanation for the lack of penetration of the gamma-globulins to the vitelline circulation in the rat,

while other species show ready transfer, is the absence in the rat of "edge canals," spaces extending between the entodermal cells of the visceral wall of the yolk sac, from their apices to the basement membrane. These have been found thus far only in the guinea pig, a species which shows prenatal transfer of immunity.

93 pages. $1.50. Mic 57-310

DIFFERENTIATION OF AND HOST REACTION TO HOMOPLASTIC INTRACEREBRAL IMPLANTS OF EMBRYONIC RAT RUDIMENTS WITH EMPHASIS ON ENDODERMAL DERIVATIVES

(Publication No. 19,689)

Gail Sanner Crouse, Ph.D.
University of Michigan, 1956

In order further to investigate the suitability of the brain for use as a transplantation site, and also to determine the potency of mammalian endodermal derivatives for self-differentiation, gut primordia from albino rat embryos were transplanted into the brains of postnatal growing albino rats. For comparison, primordia of kidney, gonads and limb buds were transplanted homoplastically to rat brains, and limb buds from the mouse were transplanted heteroplastically to the brain of the rat.

Donors of the homoplastic grafts ranged in post-coital age from 11 to 20 days, and the hosts varied in age from 4 to 16 days post-partum. Most of the animals used were of a local (M) strain, although a few animals of the Wistar strain were used for inter-strain grafting. Small pieces of the donor tissue were drawn into a number-19 hypodermic needle and injected through the frontal region of the right side of the skulls into the brains of host rats. After implantation the host brains were removed at intervals ranging from 7 to 92 days, fixed with Bouin's fluid, cleared in amyl acetate, embedded in paraffin, and sectioned at 8 micra on a rotary microtome. Representative sections were mounted, dried, and stained by Heidenhain's triple azan technique.

Implanted rudiments of stomach, duodenum, and lower small intestine displayed differentiation of all the layers and specialized cells of the normal gut wall. Grafts of the stomach and duodenum exhibited a tendency to tubulate, often with inversion of their layers. The liver and kidney showed almost no capacity to grow and differentiate. Some successful grafts of pancreas displayed an extensive duct system with scattered islet tissue, while in others differentiation was predominately acinar. Ovarian grafts fixed at successive times after implantation exhibited a normal sequence of growth of follicles and finally, in order grafts, differentiation of lutein-like tissue. Grafts of the testis in similar manner showed increasing differentiation of the epithelium of the seminiferous tubules, but spermatids and mature sperm cells were never observed. In transplants of the limb bud most of the elements of the skin differentiated, and all stages of differentiation, calcification and endochondral ossification of cartilage were observed.

More success was obtained when embryonic tissues were transplanted to old hosts than when the usual newborn rats received old donor tissue, but neither of these two groups was as successful as the series in which embryonic donors and new-born hosts were used. Results of experiments concerned with the effects of variation in size of donor tissue and with inter-strain relationship were inconclusive. When skin and intestine were implanted simultaneously, they grew and differentiated together as well as similar rudiments developing independently. Heterografts of mouse limb bud survived and underwent good differentiation of cartilage.

The principal effect of the presence of the graft tissue on the brain was cavitation of the transplant site. Irregularities of the wall of the cavity and sloughing of ependymal cells suggested that cavitation was caused by erosion. No cellular reactions of the host against the donor tissue, other than occasional concentrations of neuroglia cells in the brain, were observed in any of the grafts. Regression, which was sometimes noted, was attributed to poor vascularization or to the injurious action of circulating toxins or antibodies. An environment free of cellular infiltrations, an effective blood-brain barrier to possible toxins or antibodies, or a detoxification or neutralization of toxins or antibodies either by brain or by graft tissue may be factors which lead to the general success of grafts to the brain.

92 pages. $1.50. Mic 57-311

ON THE BIOLOGY AND CONTROL OF THE NORTH AMERICAN CHESTNUT WEEVILS

(Publication No. 17,806)

Warren Thurston Johnson, Ph.D.
University of Maryland, 1956

Supervisor: Professor E. N. Cory

Curculio auriger (Casey) and Curculio proboscideus Fab. are indigenous North American nut weevils and attack only the fruits of chestnut and chinquapin. Their natural distribution occurs over the same geographical areas that the American chestnut was found. Since the destruction of most of the native chestnut trees by chestnut blight, Endothia parasitica (Murr.), the weevils have been able to survive on scattered plantings of oriental chestnuts which are resistant to blight, from a few native chestnut trees partially resistant and from the coppice growth of old chestnut stumps.

Rearing of both species in the field was accomplished by the use of soil cages set into the ground to a depth of 12 inches. Adult behavior was studied in large cages that completely covered the tree.

Chestnut weevils lay their eggs in the kernel. The eggs of C. auriger hatch in about eight days and those of C. proboscideus hatch in about 10 days under the conditions in central Maryland. There are four larval instars in each species and these are described and illustrated. Head characters were found that will separate the species and the instars. C. auriger completes its larval development in 21 days while it takes 30 days for C. proboscideus.

The pupae of both species are of the exerate type and may be separated by the presence of two small bristles on the beak, near the insertion of the antennae, of C. auriger. These bristles are lacking in C. proboscideus.

The usual life cycle of C. auriger is two years. The life cycle of C. proboscideus is usually one year. A few

individuals of each species require an additional year to complete their cycle. The adult C. auriger issues from the ground in May and feeds on the chestnut catkins. After the catkins wither they disperse and are not seen again until the chestnuts are nearing maturity. C. proboscideus issues from the ground late in July and may be seen in the trees a few days after emergence.

The male genitalia were studied for taxonomic characters. These characters are sufficiently clear so that the two chestnut weevils may be identified thereby.

Two species of internal insect parasites were found. Myiophasia nigrifrons Tns., a tachinid fly, was reared from the larvae of both species of chestnut weevils and was observed in its larval stage within the body cavity of the chestnut weevil larva. Urosigalphus armatus Ashm. is a braconid parasite and was found only in the larvae of C. proboscideus.

Chemical control studies have shown that the adult stage is the most susceptible to insecticides. Preliminary tests with heptachlor, applied at the rate of six to eight pounds of the chemical per acre, as a spray or dust to the ground cover under the trees, have given excellent results for the control of chestnut weevils.

88 pages. $1.50. Mic 57-312

THE BIONOMICS AND DIGESTIVE ENZYMOLOGY OF SEVERAL SPECIES OF SARCOSAPROPHAGOUS CALLIPHORIDAE AND SARCOPHAGIDAE

(Publication No. 17,510)

Adel S. Kamal, Ph.D.
State College of Washington, 1956

The bionomics and digestive enzymology of thirteen species, representing nine genera within the families Sarcophagidae and Calliphoridae, were studyed. These species were: Wohlfahrtia opaca (Coq.), Sarcophaga coolevi Park., Sarcophaga shermani Park., Sarcophaga bullata Park., Protocalliphora avium (S. and D.), Phormia regina (Meig.), Protophormia terrae-novae (R. D.), Phaenicia sericata (Meig.), Eucalliphora lilaea (Walker), Cynomyopsis cadaverina (R. D.), Calliphora vomitoria (L.), Calliphora vicina R. D., and Calliphora terrae-novae Macq.

Life history data of eleven species (all except Wohlfahrtia opaca and Protocalliphora avium) which were reared successfully at 80° ± 2° F. and 50 ± 2 per cent relative humidity are tabulated and discussed. Controlled temperature and humidity as employed here, speeded up the life cycle and shortened the adult life span in comparison with fluctuating conditions of room temperature. Beef liver was the most suitable medium for rearing and for oviposition. With the exception of Eucalliphora lilaea, all species studied avoided hog liver as a rearing medium. With the exception of E. lilaea, all calliphorids studied here required protein meal prior to copulation. This is not necessary in the case of sarcophagids. Both protein and carbohydrates were required for oviposition. Severe competition for food prolonged the larval feeding period and gave rise to a large population with small sized individuals. Sex ratio, however, remained unaffected in underfed populations. The inherent ability of a given species to meet the critical shortage of food supply varies from one species to the next and is dependent upon (1) the ability of the species to reduce individual size to a minimum and yet remain viable, (2) its minimum food requirements per individual, and (3) its rate of larval development. The possible significance of these inherent abilities is in providing the mechanism of adaptation, which in turn influences distribution and population density of the species.

The distribution of seven digestive enzymes, namely, amylase, maltase, sucrase, lactase, butyrase, pepsin, and trypsin in the larval alimentary canal was determined. Tissues of midgut showed the richest variety and number of digestive enzymes. No pepsin or amylase activity was found in any part of the digestive system of any species studied. A definite reduction in digestive enzyme type and distribution is reported for the obligate parasite of nestling birds, Protocalliphora avium. Similar reduction in enzyme variety and extent is also reported for the facultative parasitic larvae of Phormia regina and Protophormia terrae-novae. Positive butyrase activity is reported from the salivary glands of Protocalliphora avium and Wohlfahrtia opaca. Similarly, a questionable activity of this enzyme is reported from esophagus of Phormia regina, Protophormia terrae-novae, and Phaenicia sericata and from the salivary glands of members of the genus Calliphora. This may suggest more probably that parasitic forms may evolve from such stems and is in harmony with the known tendency to facultative parasitism in this group. The hindgut of both Protocalliphora avium and Wohlfahrtia opaca showed a complete absence of enzymatic activity.

The aerobic and facultative bacteria of the intestinal tract of the larvae and their rearing media were isolated and determined. Autoclaved liver infusion agar did not support larval growth, but sterile larvae of Phormia regina and Protophormia terrae-novae and Eucalliphora lilaea were successfully reared on 5 to 10 per cent sterile rabbit blood agar up to the second and third generation respectively. However, the rate of larval growth on sterile blood agar was retarded by 5 to 7 days. No effect was noticed on the pupal period. The digestive enzymes of sterile larvae were determined and compared with those of non-sterile larvae. The activity of carbohydrases reported from non-sterile larvae was due to bacterial action, since no such enzymes were reported from sterile larvae. The sterile larvae secrete proteolytic and lipolytic enzymes which are necessary for normal growth.

94 pages. $1.50. Mic 57-313

A COMPARATIVE STUDY OF RESPIRATION, CYTOCHROME OXIDASE, APYRASE, AND NON-SPECIFIC ESTERASE ACTIVITIES AMONG LETHAL HYBRID, GYNOGENETIC HAPLOID, AND DIPLOID AMPHIBIAN EMBRYOS

(Publication No. 19,703)

Vilma Gloria Lavetti Kohn, Ph.D.
University of Michigan, 1956

Comparative studies of oxygen consumption and cytochrome oxidase, apyrase and non-specific esterase activities were made of normal diploids and gynogenetic haploids of Rana pipiens and of two lethal hybrids (R. pipiens♀ x R. catesbeiana♂, R. pipiens♀ x R. sylvatica♂ from the

time of fertilization to about 150 hours after fertilization. These experiments were performed in an attempt to see whether there existed a relationship between the developmental abnormalities of haploids and hybrids and the levels of the enzymes mentioned above, and thereby to understand somewhat more fully the nature of the morphogenetic blocks characteristic of each condition.

Haploids did not deviate significantly from the controls in enzyme behavior, but showed slightly less oxygen uptake beginning at Shumway Stage 17. The hybrid R. pipiens♀ x R. catesbeiana♂ did not gastrulate and began to show cytolysis at about 70 hours. Its oxygen uptake was similar to that of the controls up to 24 hours after fertilization and declined thereafter. The apyrase and cytochrome oxidase activities of this hybrid paralleled control activities long after cleavage had stopped (50-150 hours), while the non-specific esterase levels were similar to control levels until about 20 hours after the development of this animal had ceased. The second hybrid cross, R. pipiens♀ x R. sylvatica♂, formed a small dorsal lip but developed no further. This embryo characteristically became swollen, ciliated, and lived for 5-7 days in this arrested state. It showed a depressed respiratory rate beginning at control Stage 10, whereas control rates increased markedly at this time. The cytochrome oxidase and non-specific esterase activities of this hybrid were consistently higher than those of the controls from the time of the appearance of the morphogenetic block to the time of death 5-7 days later. Apyrase levels in this hybrid however, were diminished to control Stage 21.

It was evident from the hybrid studies that the block to development at gastrulation was not the result of similar enzymatic activities, i.e. that there were two different lethal mechanisms operating. The R. pipiens♀ x R. sylvatica♂ hybrid development seemed to have been interfered with in every enzyme tested, while the other hybrid, R. pipiens♀ x R. catesbeiana♂, showed no consistent deviation from the controls. The haploid syndrome is apparently also a function of a metabolic disturbance not directly measured in this study. 101 pages. $1.50. Mic 57-314

ALTERATION OF GROWTH AND DIFFERENTIATION OF RANA PIPIENS EMBRYOS BY BENZIMIDAZOLE

(Publication No. 18,625)

Lucia Manikis y Alonso, Ph.D.
University of Michigan, 1956

The object of this investigation was to elucidate the role of nucleic acid metabolism in the embryonic differentiation and morphogenesis of the frog, Rana pipiens. Efforts were made to alter normal nucleic acid metabolism by immersing embryos in solutions of benzimidazole. The antimetabolite benzimidazole is an inhibitory analog of the purines, which are essential constituents of nucleic acid. Embryos were immersed in benzimidazole solutions during four critical stages of development – that is, at the 2-cell, blastula, gastrula, and neurula stages. Effective concentrations of benzimidazole ranged from 10^{-3} M to 10^{-4} M; higher concentrations were lethal and lower concentrations were innocuous. The duration of treatment varied from one to seventy-two hours. Various purines or their derivatives – adenine, guanine, hypoxanthine, xanthine, adenosine, and adenylic acid – and the pyrimidines cytosine, thymine, and uracil were used separately and simultaneously with benzimidazole to test the ability of these compounds to reverse or reduce the inhibitory effects of benzimidazole. Adenine slightly retarded the effects of benzimidazole, while the other compounds were either ineffective or accentuated the effects of benzimidazole.

Embryos treated with benzimidazole exhibit a wide range of irreversible abnormalities correlated with the duration and intensity of treatment and with the age of the embryo at the time of treatment. Typical abnormalities consisted of retarded growth, abnormal mitoses, absence of cellular differentiation, cellular dedifferentiation, arrested or erratic morphogenetic movements, and grossly disorganized morphogenesis of most organ systems. The potentialities for growth and differentiation of benzimidazole-treated tissues and embryos were further tested by transplanting treated tissue to normal hosts and by joining treated and normal embryos in parabiotic union. Contact with normal tissues failed to mitigate the inhibitory effects of benzimidazole treatment, and, in fact, the treated tissues invariably exerted a toxic effect on the normal tissues.

Histochemical tests with Korson, Feulgen, and Unna-Pappenheim stains showed a decrease in both desoxyribonucleic and ribonucleic acids in the cells of benzimidazole-treated embryos. Physiological (as opposed to developmental) effects of benzimidazole were shown in the depression of respiratory activity approximately 50% in treated embryos, and by reduction of apyrase activity in the tissues of treated tadpoles.

The following conclusions may be drawn from the data: a) benzimidazole inhibition in embryonic tissue is irreversible; b) the sensitivity of embryonic tissues to bensimidazole varies and is correlated with the metabolic condition and state of differentiation of the tissue during the time of treatment; c) benzimidazole inhibits the synthesis of apyrase and nucleic acid and reduces respiration; d) the mechanism of benzimidazole inhibition remains unknown but appears not to involve a simple competitive inhibition of purines or pyrimidines; hypotheses that assume an interference with nucleic acid metabolism, or with nucleic acid synthesis, or with the physiological activity of purine-containing essential metabolites, all may be used to explain plausibly the mechanism of benzimidazole inhibition.
173 pages. $2.30. Mic 57-315

A REVIEW OF THE NEARCTIC SPECIES OF THE GENUS HYPERODES JEKEL (COLEOPTERA: CURCULIONIDAE)

(Publication No. 19,788)

William Denis Stockton, Ph.D.
Cornell University, 1956

This paper is a review of the taxonomy of those species of weevils at present placed in the genus Hyperodes Jekel. In addition all the available information concerning the biology of the species is presented. Illustrations of the

male genitalia of most of the species, and a key to the entire group, are included to aid the student in identification.

A total of fifty-two species names have been applied in this genus. Seven of these had been reduced to synonomy previous to the present paper: H. spurcus (Boh.), H. ulkei (Dietz), H. indistinctus (Dietz), H. wickhami (Dietz), H. lineatulus (Say), H. squalidus (Gyll.), and H. longulus (Dietz). During the course of the present study I have placed thirteen more in synonomy: H. solutus (Boh.), H. nevadensis (Dietz), H. tenebrosus (Dietz), H. interpunctatulus (Dietz), H. interstitialis (Dietz), H. setiger (Dietz), H. schaupii (Angell), H. subscribratus (Dietz), H. immundus (Boh.), H. latiusculus (Boh.), H. mirabilis (Dietz), H. myasellus (Dietz), and H. minimus Blatchley. Three species are described as new in the present paper: H. wallacei, H. hoodi, and H. texana.

I have studied the types of all the species except H. squalidus (Gyll.), which I could not locate, and the species of Say, which I believe to have been destroyed. The types of Kirby in the British Museum could not be loaned, but I have studied specimens compared with those types by Dr. J. Balfour-Browne. Neotypes have been designated for the species of Say, and lectotypes for H. horni (Dietz) and H. hyperodes (Dietz). The single specimen which Dietz had before him when he described Macrops alternatus has been designated as the holotype of H. alternata (Dietz). No lectotypes have been designated for the species of Dietz of which the type series are at the Museum of Comparative Zoology. 135 pages. $1.80. Mic 57-316

A REVISION OF THE GENUS NOTURUS RAFINESQUE WITH A CONTRIBUTION TO THE CLASSIFICATION OF THE NORTH AMERICAN CATFISHES

(Publication No. 19,721)

William Ralph Taylor, Ph.D.
University of Michigan, 1956

The purposes of this study are to determine the phylogeny of the North American catfishes, family Ictaluridae (formerly Ameiuridae), and to analyze the species of Noturus and Schilbeodes, here grouped as the genus Noturus Rafinesque.

In order to interpret their relationships, an investigation was made of the external morphology and osteology of the fishes assigned to the Ictaluridae. The recognized species constitute six genera which form three major natural groups. Each encompasses one monotypic genus that is blind, unpigmented, and of restricted subterranean range and one genus with species that are eyed, pigmented, and of widespread occurrence in surface waters. The divisions are: (1) an Ictalurus group including the genus Ictalurus Rafinesque and, provisionally, Trogloglanis pattersoni Eigenmann, (2) a Noturus group containing that genus and Prietella phreatophila Carranza, and (3) a Pylodictis group consisting of Pylodictis olivaris (Rafinesque) and Satan eurystomus Hubbs and Bailey. The morphology of the genera is discussed and treated comparatively. It appears that the phylogenetic groups of the Ictaluridae stem from a common ancestor in North America, probably in the early Tertiary.

An examination was made of most of the available museum specimens of madtoms and stonecats, genus Noturus. These were determined to represent twenty species. They are described and illustrated and their ranges are defined and mapped on the basis both of the specimens examined and a review of the literature. Variational data, which form the background for the description of each species, are presented; the data were taken from random samples of specimens collected throughout the range of each species. Some variations, such as in number of caudal rays of Noturus gyrinus, are found to form geographic gradients or clines; others, for example the degree of pigmentation and fin-ray counts in Noturus exilis, form an irregular geographic pattern. Some species, e.g. Noturus miurus, show relatively high constantancy, over a wide area. Notes on the ecological relationships of each species are given. Observations were made on the life history of Noturus miurus and Noturus stigmosus, and the structure of the young of Noturus miurus is discussed. Three hybrid individuals of two interspecific crosses are described and are compared with their parental species.

The nominal genera Schilbeodes Bleeker, Pimelodon Vaillant, Noturus Rafinesque, and Rabida Jordan and Evermann are regarded as acceptable subgeneric divisions of the genus Noturus. Two of these are monotypic: Schilbeodes represented by Noturus gyrinus (Mitchill), and Noturus by Noturus flavus Rafinesque. The subgenus Pimelodon contains Noturus leptacanthus Jordan, Noturus nocturnus Jordan and Gilbert, Noturus insignis (Richardson), Noturus funebris Gilbert and Swain, Noturus exilis Nelson, and Noturus gilberti Jordan and Evermann. The subgenus Rabida includes Noturus hildebrandi (Bailey and Taylor), Noturus eleutherus Jordan, Noturus furiosus Jordan and Meek, and Noturus miurus Jordan in addition to eight species which are described as new. The natural relationship of the species of Noturus and the evolution of their characters are discussed.

592 pages. $7.50. Mic 57-317

AUTHOR INDEX

DISSERTATION ABSTRACTS

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